A PICTORIAL SURVEY OF CURRENT PRACTICE, EQUIPMENT AND MATERIALS

Construction Methods

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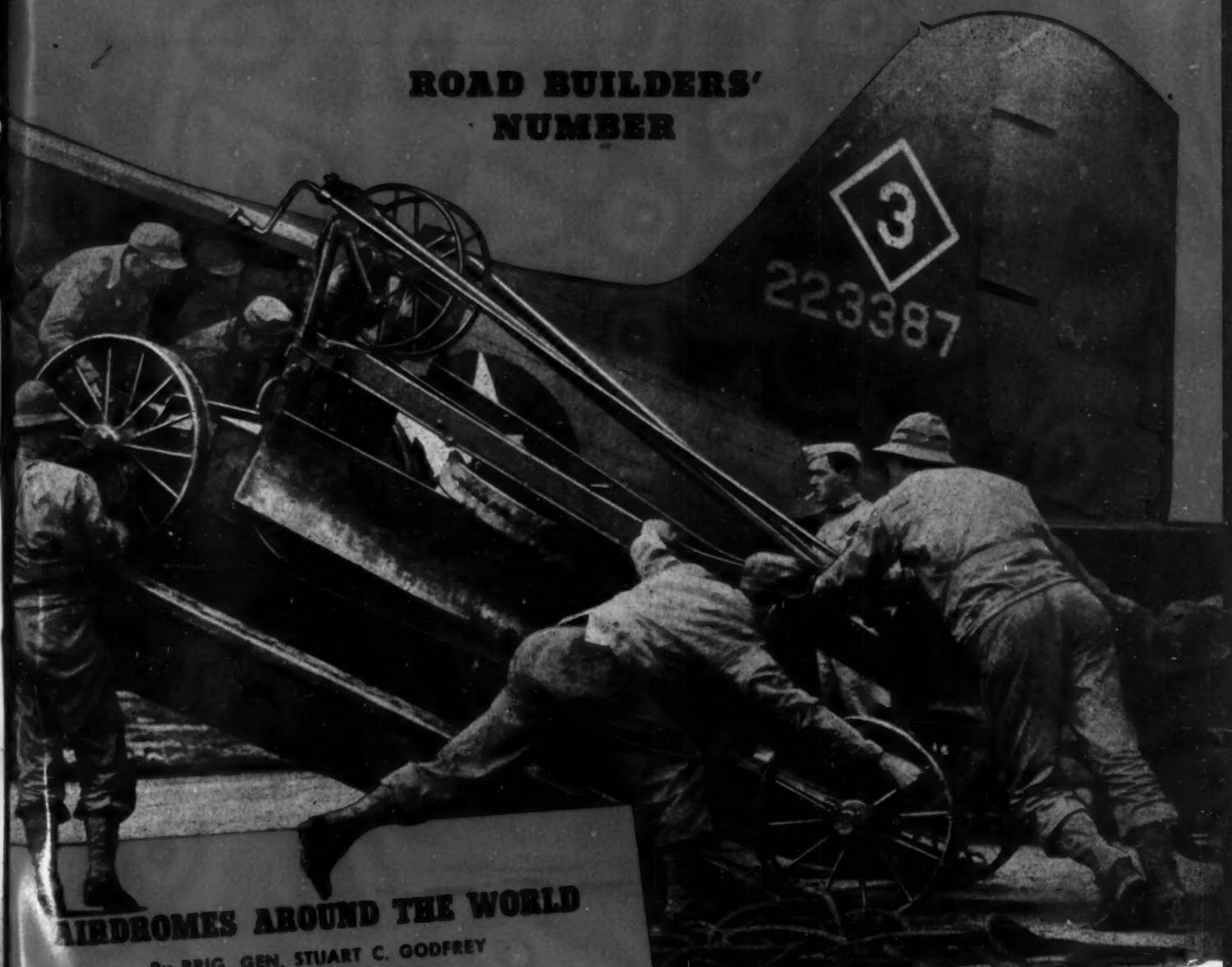
ROAD BUILDERS' NUMBER



FOR AIRBORNE TRANSPORT, leaning-wheel road grader for airfield construction is loaded into plane by Aviation Engineers.

AIRDROMES AROUND THE WORLD

By BRIG. GEN. STUART C. GODFREY
Air Engineer, Army Air Forces

How road-building methods and "bantam" equipment, transported by plane, are applied by Aviation Engineers to constructing airfields in theaters of war.

FEBRUARY 1944

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CURRENT JOBS

. . . and Who's Doing Them

BUILDINGS

Public—Contract for brick, steel malleable foundry in Ohio was awarded to **Rust Engineering Co.**, of Pittsburgh, Pa., for $3,360,000. Temporary family dwelling units at San Diego, Calif., will be built by **E. S. McKittrick Co.**, of Huntington Park, for $3,201,508. **Thompson Starrett Co., Inc.**, of New York, N. Y., was low bidder on $2,000,000 Army contract for cantonment additions. Navy contract for housing facilities in Maryland went to **Harwood-Nebel Construction Co., Inc.**, of Washington, D. C., for $1,836,000. **Hardaway Contracting Co.**, of Columbus, Ga., has $1,696,000 Navy hospital contract. **Robert E. McKee**, of El Paso, Tex., will construct buildings in Waco for $1,483,000. Contract for $1,400,500 for buildings in Lyons, N. J., was awarded to **Amsterdam Building Co.**, of New York, N. Y. Low bid of $1,398,000 on Navy officers' quarters at Patuxent River, Md., was received from **John A. Johnson & Sons**, of Brooklyn, N. Y. **Gorelnik Co.**, of Los Angeles, Calif., will build dwellings for $1,283,534.

Commercial—Contract for $1,350,000 for brick dwellings in Turners Station, Md., was awarded to **Day Construction Co.**, of New York, N. Y.

Industrial—Brown & Root, Inc., of San Antonio, Tex., have contract for $3,200,000 factory in Texas.

HEAVY CONSTRUCTION

Contract for $1,400,000 for drainage tunnel to unwater mines in Leadville, Colo., was awarded to **Stiers Bros. Construction Co.** of Leadville and St. Louis, Mo. Covered storage at San Francisco, Calif., will be built for Navy by **Morrison-Knudsen Co.**, of San Francisco, for $1,033,000. Contract for hydraulic process dredging and placing materials for construction of embankments for airport runways at East Boston, Mass., was awarded to **Gahagan Construction Co.**, of Brooklyn, N. Y., for $909,600.

HIGHWAYS

Among recent highway contract awards are the following: Georgia: $682,033 to **R. A. Bowen**, of Macon. Michigan: $205,796 to **Darin & Armstrong**, of Detroit. Nevada: $308,335 to **C. E. Nelson**, of Logan. North Carolina: $229,416 to **F. D. Cline**, of Raleigh. Ohio: $750,000 to **Walsh Construction Co.**, of New York, N. Y.; and $223,600 to **Pierce Construction Co.**, of Toledo. Oklahoma: $397,000 to **Brown & Root, Inc.**, and **W. S. Bellows Construction Co.**, of McAlester. Oregon: $385,937 to **Rogers Construction Co.**, of Dayton, Wash. Utah: $469,875 to **Hunt & Frandsen**, of Elko, Nev. Washington: $278,790 to **R. E. Rush** and **G. F. Baird**, of Port Angeles.

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Construction Methods

A Pictorial Survey of Current Practice, Equipment and Materials

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Editorial Staff: Vincent B. Smith, Paul Wooton (Washington) N. A. Bowers (San Francisco) Nelle Fitzgerald Patricia McGerr

FEBRUARY, 1944

THE *How* OF IT

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

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How **RAILWAY TRACKS** were destroyed by German wrecker —p. 53

How **AIRBORNE AVIATION ENGINEERS** provided air bases in theatres of war —p. 54

How **"BANTAM" EQUIPMENT** of types common in road-building practice was transported by plane —p. 56

How **NATIVE WORKERS** constructed runways at Army airdromes —p. 58

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How **FLEXIBLE PAVEMENT** on sound base provided durable test track for Army tanks —p. 78

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How **SPECIAL WOODEN TEMPLATES** assured accurate setting of flush expansion joints —p. 85

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CHANGE OF ADDRESS

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To .....

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Signed .....

Free Enterprise

. . . *INCENTIVES AND TAXATION*

THERE are three principal ways of making a living:

1. Getting on someone's payroll
2. Lending one's savings to business enterprises
3. Starting, or helping to start, a business enterprise

About three out of four of us fall in the first group—we are *job-holders*. Millions of us get some income, large or small, by lending our savings—directly or through such channels as insurance companies. We are suppliers of *loan-capital*. About one out of four of us has his own business enterprise, and several millions of us are part owners of business enterprises. Those of us who go into business for ourselves and those of us who are part owners of enterprises are *job-givers*.

The amount of employment in a community depends, in the main, on the number of persons who attempt to make their living, or part of their living, by giving jobs to others, rather than by getting on someone's payroll. A community seriously desiring a high level of employment and a high standard of living will strive to make job-giving attractive and to encourage a large part of its population to be job-givers rather than merely job-holders.

The number of men who attempt to make their living in whole or in part by starting new businesses or by expanding old ones depends upon the outlook for profits. When the outlook for profits improves, thousands of new jobs open up and thousands of men go to work; and, as men go to work, the farmer and everybody else benefits. When the prospect for profits becomes darker, the demand for labor, capital, and raw materials drops. It may be roughly estimated that an improvement in the prospects for profits of one billion dollars raises the demand for labor by anywhere from two billion dollars to five billion dollars.

One of the principal determinants of the outlook for profits is the amount and the nature of taxes. After the war, the Federal government will need to raise each year about twenty billion dollars in taxes—three times the amount required before the war, and six times the amount required in the Twenties. In the Twenties, the tax needs of the Federal government were roughly twice as large as corporate profits in a good year. After the war, Federal revenue needs will be roughly three times corporate profits in a good year. Obviously, it will be much more difficult, after the war, for the government to meet its needs *without discouraging enterprise*, and therefore without diminishing the number of jobs, than it was before the war. Far more than ever before, it will be necessary for the government in developing a tax program to take account of the effect of taxes upon employment and the standard of living. This means that it will be important for each and every citizen to give attention to these matters—because the policies of the government reflect, in the main, the thinking of the citizens.

Some taxes seriously discourage individuals and business firms from undertaking new and enlarged operations. Other taxes have little or no adverse effect on investments. Some taxes are a burden on consumption, affecting the sales of specific commodities, depending on the nature of the taxes. It is obvious that different kinds of taxes have different economic influences. *We must understand the forces that determine the level of employment and consider the tax program in relation to other measures designed to create more jobs.*

What are the tests of a good tax system?

1. Taxes should be designed to encourage production and enterprise and to make it attractive for a large number of people to earn all or part of their living by giving jobs to others.
2. Taxation must be fair in principle and administration, with no discrimination between persons in similar circumstances.
3. Taxes should be apparent and not concealed, and should be levied, in the main, directly upon individuals so that each of us will know how much our government is costing him. A moderate income tax at the lower income levels will bring a greater awareness of responsibility than will heavy taxes on consumption which the taxpayer does not see because they are hidden in the prices he pays.
4. In the aggregate, taxes should be somewhat progressive.
5. The tax system should be coordinated with the broader objectives of monetary and fiscal policy.
6. Federal, state, and local tax policies should be integrated as to principles and objectives.

Judged by these standards, our present tax system is extremely unsatisfactory; in fact, it is actually damaging. It is a conglomeration of hidden and direct taxes and of conflicting taxing jurisdictions and policies, with no comprehensive economic motive. It is distorted to appease pressure groups and includes uneconomic punitive measures. It is full of needless complexities. It is a paradise for tax lawyers and a source of confusion and despair for the honest, enterprising business man. In fact, it would seem almost as if our tax laws had been written by some fifth columnist for the purpose of making private enterprise unworkable. We in America pretend to believe in the pioneer spirit, but no one would ever suspect it by looking at our tax system.

When the war is over, there must be a thorough reform of our entire tax system. Federal taxes can and should be reduced substantially; and, in the process of reduction, changes can more readily be introduced. At that time, steps can be taken to achieve some degree of coordination and unity of purpose among federal, state, and local taxing agencies. Taxes play too important a role in our total economic life to ignore the adverse consequences of unrelated and inconsistent policies of different taxing jurisdictions.

The following reform measures are needed in federal taxation:

1. Repeal of the excess profits tax at the earliest possible date after inflationary dangers subside. In the case of most enterprises, the excess profits tax destroys all incentive to do a larger volume of business than in 1939; it appropriates virtually all increase in profits above the level of 1939.
2. Coordinate corporation and individual income taxes so as to avoid double taxation and impediments to risk-taking. Preferably, corporation income taxes should be wholly eliminated. Otherwise, the corporation tax rates should be reduced to the lowest effective rate on personal incomes. Full credit should be given to stockholders for all corporate income taxes paid.
3. Encourage competition and particularly the formation of new enterprises by allowing new corporations generous tax exemptions for a period of five years. Extend the same principle to unincorporated concerns.
4. Encourage risk-taking (and hence job-giving) through extending the loss carry-over to six years or more.
5. Provide for averaging incomes over a period of years in order to remove discrimination against those with irregular incomes and those who take risks of loss in business ventures.
6. Rely upon the personal income tax as the main source of revenue, with broad coverage. The reduction in total taxes after the war should favor the elimination of excise taxes before reducing income taxes.
7. Reduce the upper range of personal income tax rates to a maximum of perhaps fifty to sixty per cent so that risk-taking investments will be really attractive. Higher rates are punitive in character, yield small receipts, and throttle risk-taking.
8. Encourage risk-taking by individuals in the higher brackets by making the surtax on incomes of $20,000 a year or more half as much on income in the form of dividends as on income in the form of salaries or interest.
9. Encourage risk-taking by individuals by permitting capital losses to be charged against general income provided the reduction of tax liability in any one year is not more than fifty per cent.
10. Repeal the tax-exempt privilege for all *new* securities issued by all governmental jurisdictions.
11. Eliminate excise taxes which place a disproportionate burden on persons with lower incomes so as to encourage greater consumption and provide an expanded market for our vast industrial capacity.
12. Reform tax administration to simplify forms and procedures, to broaden the scope of enforcement, and to encourage the spirit of fairness.

With such reforms and continuing reappraisal of the tax program as it affects the economic situation, we can look toward taxation as an instrument of constructive influence in giving the fullest encouragement to free enterprise and in attaining continued prosperity.

James H. McGraw, Jr.

President, *McGraw-Hill Publishing Company, Inc.*

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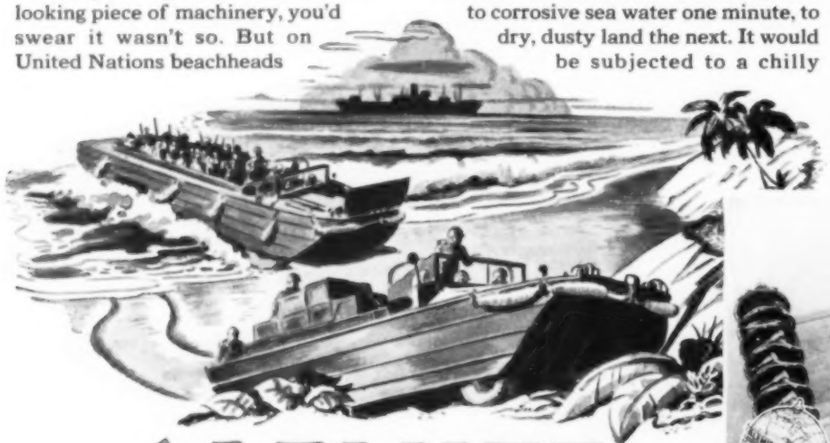

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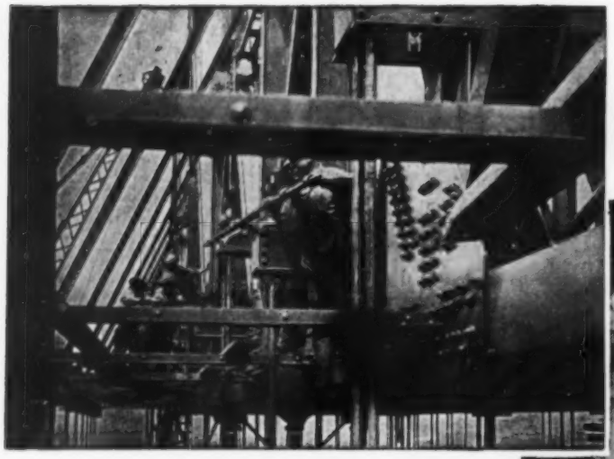

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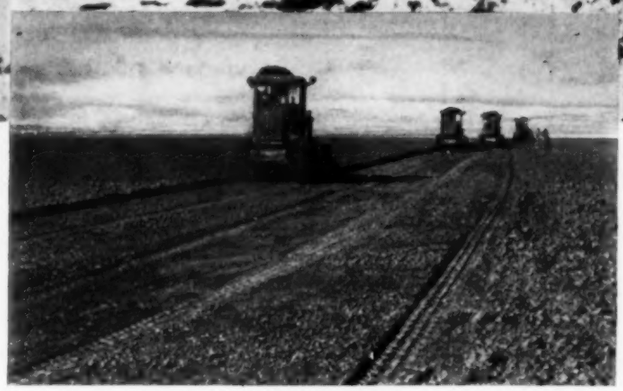

• (Upper view) *A fleet of "Caterpillar" Diesel Motor Graders at work on a big landing field for Allied planes in the North African war zone.*

• (Bottom) *In New Guinea, this "Caterpillar" Diesel Tractor with sheep's-foot roller and "Caterpillar" Diesel Motor Grader build a new air strip.*

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Rapid City — J. D. Evans Equip. Co.
TENNESSEE
Chattanooga — Nixon-Hasselle Co.
Knoxville — Wilson-Woesner-Wilkinson
Nashville—Wilson-Woesner-WilkinsonCo.
TEXAS
Dallas — Conley-Lott-Nichols Mach. Co.
Houston — R. B. Everett & Co.
UTAH
Salt Lake City — Lund Machinery Co.
VERMONT
Barre — Cassellini-Venable Corp.
VIRGINIA
Roanoke — Roanoke Tractor & Equip. Co.
Baltimore, Md. — Henry H. Meyer Co.,
Washington, D. C. — Matt A. Doetsch Machinery Co.
WASHINGTON
Seattle — L. A. Snow Company
Spokane — Empire Equipment Company
WEST VIRGINIA
Charleston — Charleston Tractor & Equip. Corp.
Pittsburgh, Pa. — Dravo-Doyle Company
WISCONSIN
Milwaukee — Hunter Tractor & Mach. Co.
WYOMING
Billings, Mont. — Western Construction Equipment Co.
Denver, Colo. — Ray Corson Mach. Co.
Salt Lake City, Utah — Lund Mach. Co.
CANADA
Halifax, N. S. — Coleman Mach. Co., Ltd.
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St. Johns, N. F. — Dominion Dist. Co.
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Winnipeg — Mumford, Medland, Ltd.

. . . for High Speed

ON ROADS AND AIRPORTS
USE THE BLAW-KNOX

TRANSVERSE BLADE AUTOMATIC CONCRETE PAVING SPREADER

AND THE

BLAW-KNOX FINISHING MACHINE

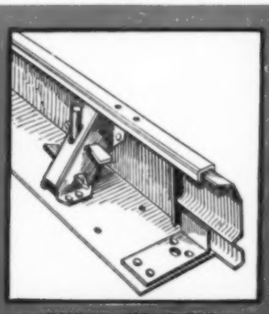
(EITHER MACHINE EQUIPPED WITH PAVING VIBRATOR IF DESIRED)

● Contractors prefer the Blaw-Knox Transverse Blade Spreader because of its enormous capacity for spreading concrete ahead of the finishing machine — its automatic spreading action regardless of where the concrete is placed on the subgrade — the absence of pressure on the side forms and avoidance of disturbing form alignment — freedom from job-interrupting breakdowns and excessive maintenance costs — does not segregate concrete regardless of maximum size of aggregate — narrow machines are convertible to wider machines and vice-versa.

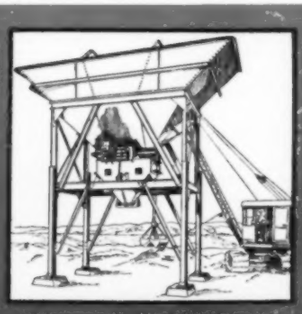
● Contractors also prefer the Blaw-Knox Finishing Machine because of the smooth finish obtained under maximum production conditions — wide screed ends prevent wastage of concrete over side forms — six traction speeds and four screed speeds for flexibility of operation to handle varying types of concrete — machine is easily and quickly adjustable for width — proper weight distribution makes machine easy on the side forms and easy to steer — low upkeep cost — easy to operate.

● The combination of the Blaw-Knox Finishing Machine and Transverse Blade Spreader has the capacity to handle the maximum output of two 34-E Dual Drum Pavers.

● See your nearest Blaw-Knox distributor about Blaw-Knox Finishing Machines and Blaw-Knox Transverse Blade Automatic Concrete Paving Spreaders for your next paving job.



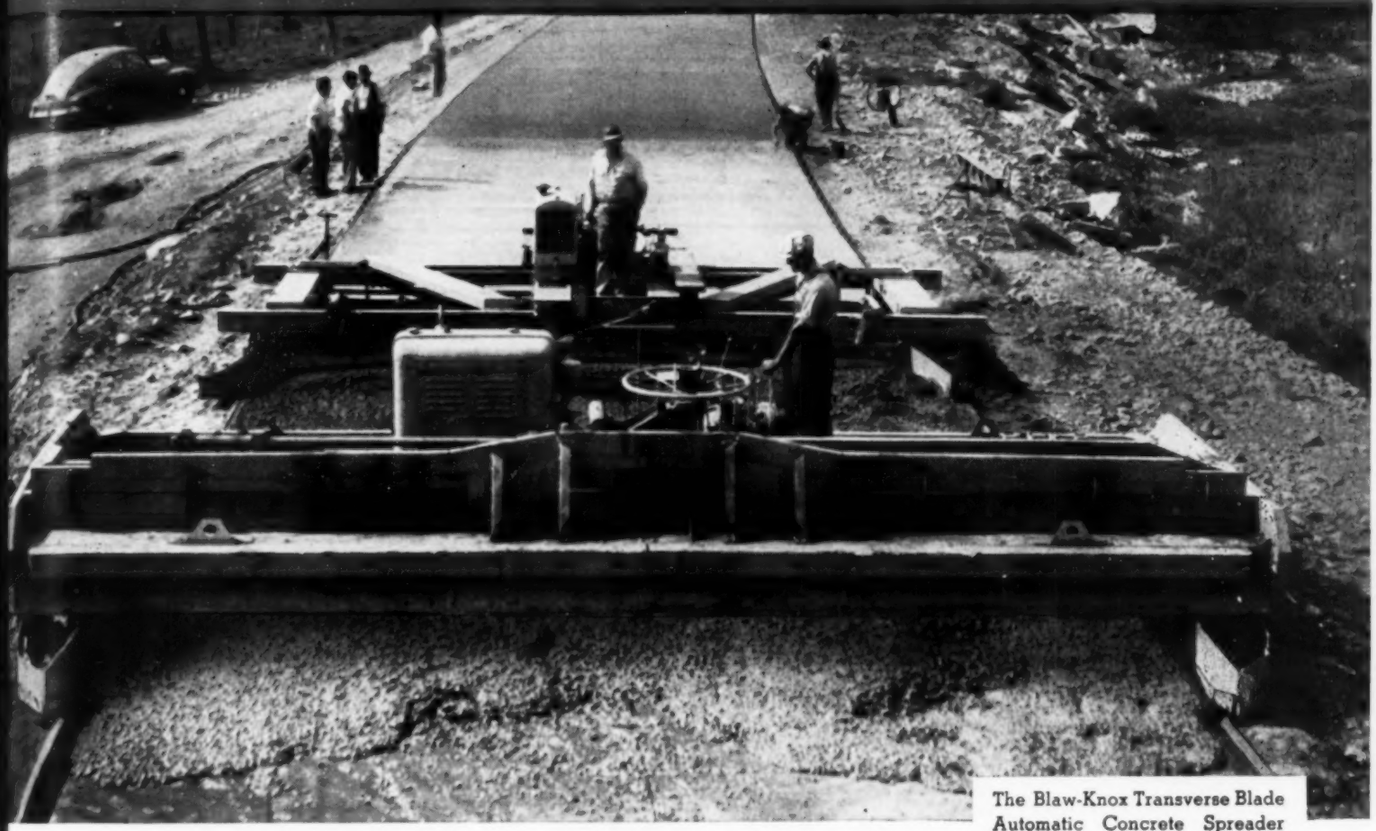
PAVING FORMS FOR AIRPORTS AND ROADS



AGGREGATE BATCHING PLANTS

CLAMSHELL BUCKETS

Quality Paving Production



The Blaw-Knox Transverse Blade Automatic Concrete Spreader and the Blaw-Knox Finishing Machine illustrated are paving the Queens Highway — the main east and west route in Ontario, Canada. The old pavement had disintegrated under heavy war traffic. Both machines are adjustable from 20 to 25 ft. widths. Photo shows paving operations on super elevated curve, 22 ft. width of slab.

- Pick for your job the machines that have made good on the world's toughest proving grounds, paving air bases and roads for the armed forces on every front.

- New points in design and construction, war inspired, will be found in the Blaw-Knox construction equipment you'll be using for post-war construction.

BLAW-KNOX

BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
2086 Farmers Bank Bldg., Pittsburgh, Pa.
NEW YORK · CHICAGO · PHILADELPHIA
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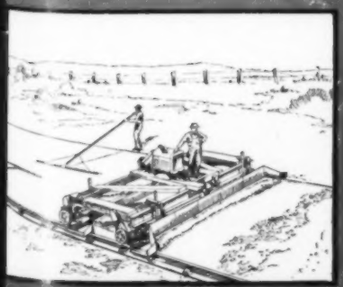
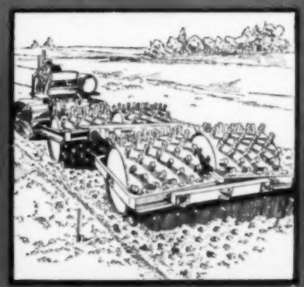
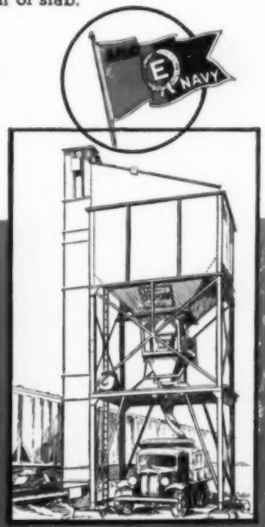


FINISHING MACHINES FOR AIRPORTS AND ROADS



SHEEPSFOOT TAMPING ROLLERS

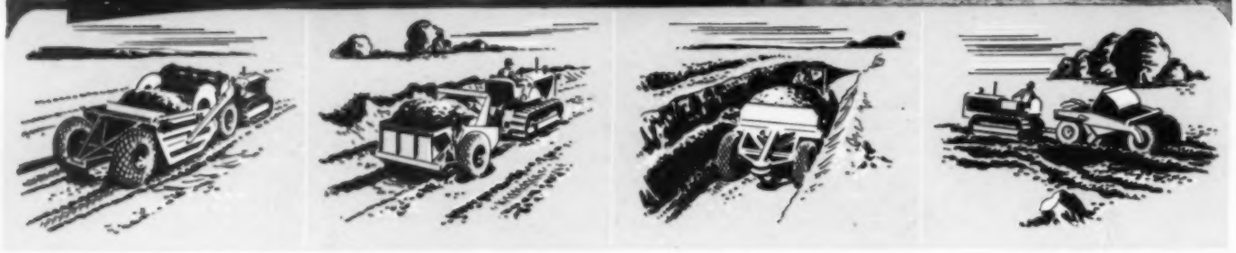
CONCRETE BUCKETS

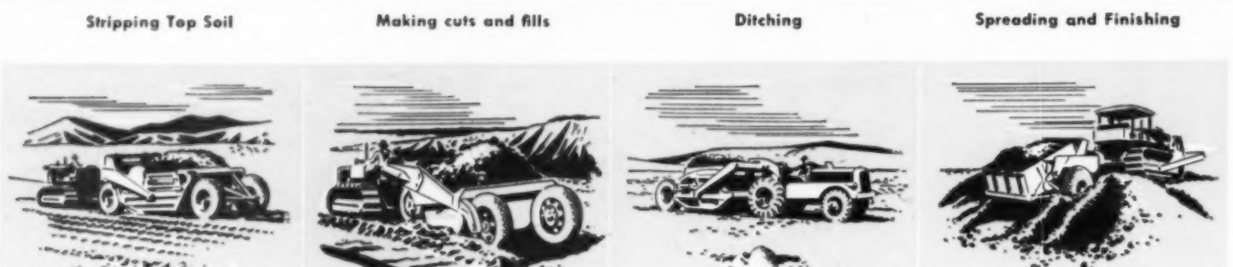


BULK CEMENT PLANTS

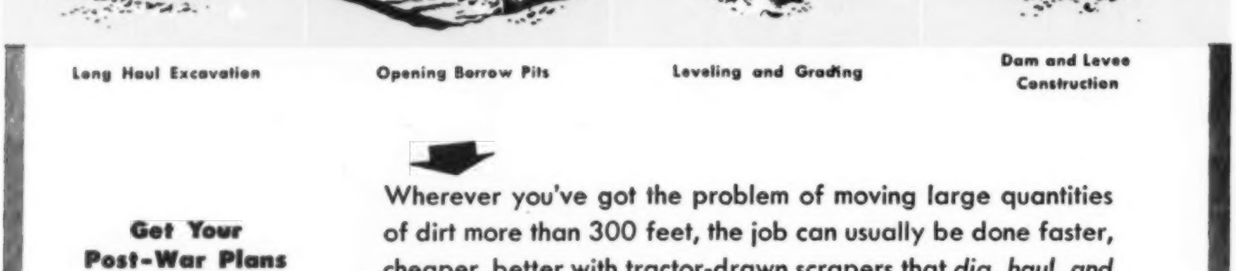
Are you taking full advantage

OF ALL THE JOBS YOUR SCRAPERS CAN DO?





Stripping Top Soil | Making cuts and fills | Ditching | Spreading and Finishing



Long Haul Excavation | Opening Borrow Pits | Leveling and Grading | Dam and Levee Construction

Get Your Post-War Plans On Paper Now!

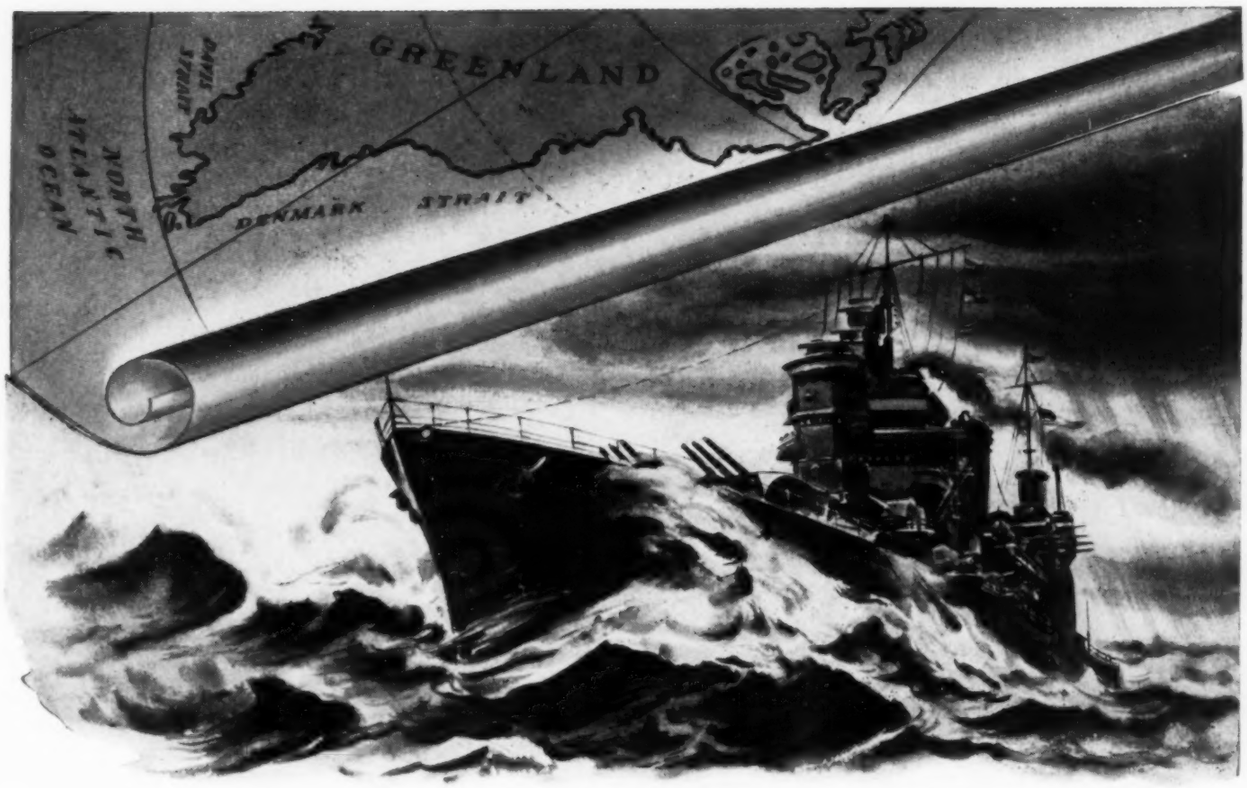
Help eliminate "leaf raking" and "made work" later by planning and promoting worthwhile construction projects now. Make your plans specific—with detailed blueprints and estimated costs worked out as closely as possible. And by all means, call in your contractors early, so that equipment and job requirements can be planned well in advance of actual needs.

Wherever you've got the problem of moving large quantities of dirt more than 300 feet, the job can usually be done faster, cheaper, better with tractor-drawn scrapers that *dig, haul, and spread their own loads.* The typical illustrations above are only a few of the hundreds of practical applications for these thrifty, versatile machines. And remember, every *extra* job you assign to LaPlant-Choate "Carrimor" scrapers enables you to save precious manpower and release less adaptable equipment for other vital war work. See your nearest LaPlant-Choate "Caterpillar" distributor for helpful job application data, plus efficient parts and repair service, designed to keep your scraper equipment working *full-time* for Victory. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa.

ARMY E NAVY

LaPLANT-CHOATE

Earthmoving and Land Clearing Equipment



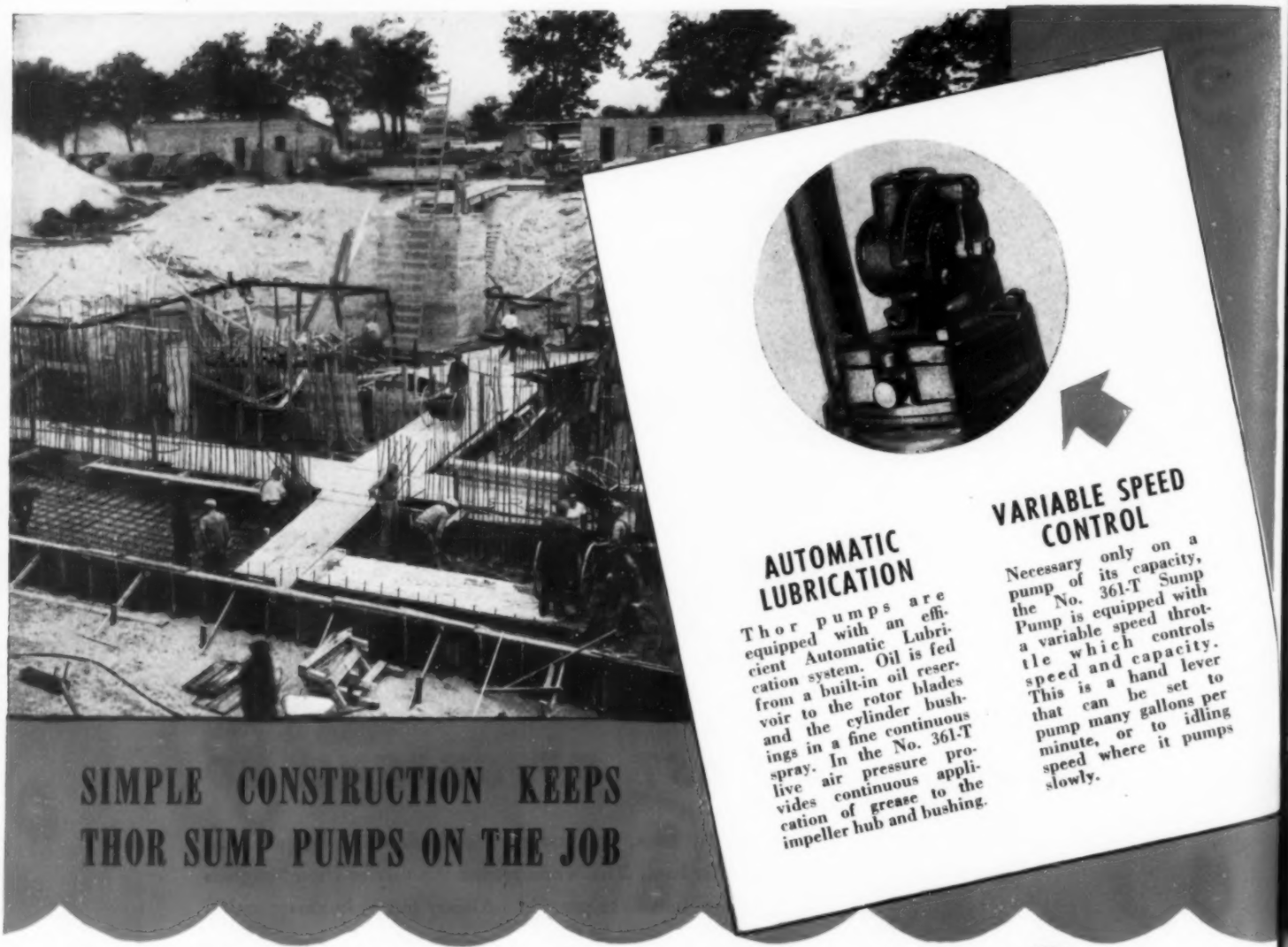
SOMEWHERE EAST OF GREENLAND

She's on her own out here, a thousand miles from a friendly port . . . twice that from a repair base. That's one reason she carries Diesel engines as well as her turbines — to provide auxiliary power in emergencies, for the operation of lights, ammunition hoists, and the like. Many smaller craft use Diesel as prime power too . . . for Diesel offers many advantages at sea — fuel economy, efficient use of bunker capacity, low fire hazard. The same advantages and others dictate the use of Diesel in countless military and commercial applications. Served by many progressive engine builders, America will enjoy rich future benefits as Diesels take over the manifold tasks for which they are ideally suited. As a supplier of fuel injection equipment to American engine builders, American Bosch continues to provide competent world-wide maintenance service, the widest variety of equipment, and experienced counsel in application engineering.

AMERICAN BOSCH CORPORATION • SPRINGFIELD, MASSACHUSETTS

AMERICAN BOSCH

AVIATION AND AUTOMOTIVE ELECTRICAL PRODUCTS • FUEL INJECTION EQUIPMENT



AUTOMATIC LUBRICATION

Thor pumps are equipped with an efficient Automatic Lubrication system. Oil is fed from a built-in oil reservoir to the rotor blades and the cylinder bushings in a fine continuous spray. In the No. 361-T live air pressure provides continuous application of grease to the impeller hub and bushing.

VARIABLE SPEED CONTROL

Necessary only on a pump of its capacity, the No. 361-T Sump Pump is equipped with a variable speed throttle which controls speed and capacity. This is a hand lever that can be set to pump many gallons per minute, or to idling speed where it pumps slowly.

SIMPLE CONSTRUCTION KEEPS THOR SUMP PUMPS ON THE JOB

Thor Sump Pumps are designed to work efficiently under the most unfavorable conditions. Because the Thor Rotary Air motor is enclosed in an air-tight housing, the pumps operate whether partially or fully submerged. Self-priming, centrifugal impeller type pumps, they operate in dirty water, oil, sludge or sewage. A variable speed throttle controls capacity and speed. An automatic lubrication system keeps all moving parts lubricated. Thor Sump Pumps have also a new design exhaust outlet that eliminates, or in damp climates minimizes, shut-downs due to freezing.

CAPACITY OF 361T

Total Head in Feet	Discharge in Gallons per Minute at Air Pressures Indicated					Total Head in Feet	Discharge in Gallons per Minute at Air Pressures Indicated				
	100 lbs.	90 lbs.	80 lbs.	70 lbs.	60 lbs.		100 lbs.	90 lbs.	80 lbs.	70 lbs.	60 lbs.
0	252	244	234	225	216	60	140	114	89	55	...
10	242	230	217	205	183	70	117	90	65	26	...
20	227	210	192	172	146	75	105	79	52	...	...
30	208	188	166	140	114	80	93	67	39	...	...
40	186	164	140	111	85	90	68	42	...	...	...
50	163	140	112	83	54	100	40	...	...	...	...

OTHER THOR AIR TOOLS: ROCK DRILLS, PAVING BREAKERS, CLAY DIGGERS, SAWS, GRINDERS.

Thor

SUMP PUMPS

No. 361T

TO KEEP YOUR JOBS "IN THE DRY"

361T SUMP PUMP

A medium size pump that is most effective up to 60 foot head. Of one-piece construction, this pump is a self-aligned, compact unit. Its motor has large ball bearings fully enclosed in grease-tight housing. Screen strainer is standard; slotted strainer furnished on special order.

Thor Sump Pumps will pump to within 1½" of the bottom. If desired, a 3" high screen can be furnished in place of standard 1½" screen.

SPECIFICATIONS

Size Sump Pump	Will Enter Opening	Length Overall	Weight Lbs.	Size Air Inlet	Discharge Opening	Size Discharge Hose
361T	8¼"x12¼	21¼"	53	½" Pipe Tap	2½" Pipe Tap	2½"

SUMP PUMP IN TANDEM

THE 361T

The 361T can be furnished to operate in tandem—two pumps connected together for high head pumping. This two stage pump has a total head of 160 feet at 90 lbs. air pressure. However, if high head pumping is not necessary the tandem pump can be disconnected and used as two separate units.

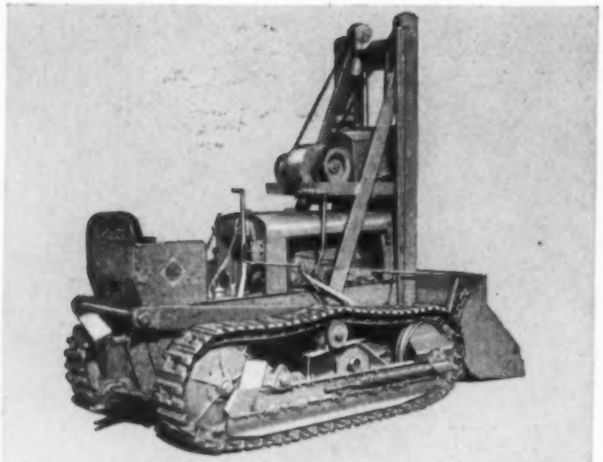
FOR FULL INFORMATION ON THOR CONTRACTORS AIR TOOLS, REQUEST THOR CATALOG 42A

Thor *Portable Pneumatic and Electric Tools*

INDEPENDENT PNEUMATIC TOOL COMPANY

600 W. JACKSON BOULEVARD, CHICAGO, ILL.

Branches in Principal Cities



Extra Duties
Which Keep Hough Shovels Busy

Snow removal and loading — ditch and stream cleaning — handling catch basin and sweeper refuse — loading under viaducts, underpasses or indoors—tree removal and loading — handling pipe, poles, ties, rails and culverts — charging asphalt and concrete mixers — and hundreds of other time-saving applications. The tractor is, of course, adaptable to all normal uses.

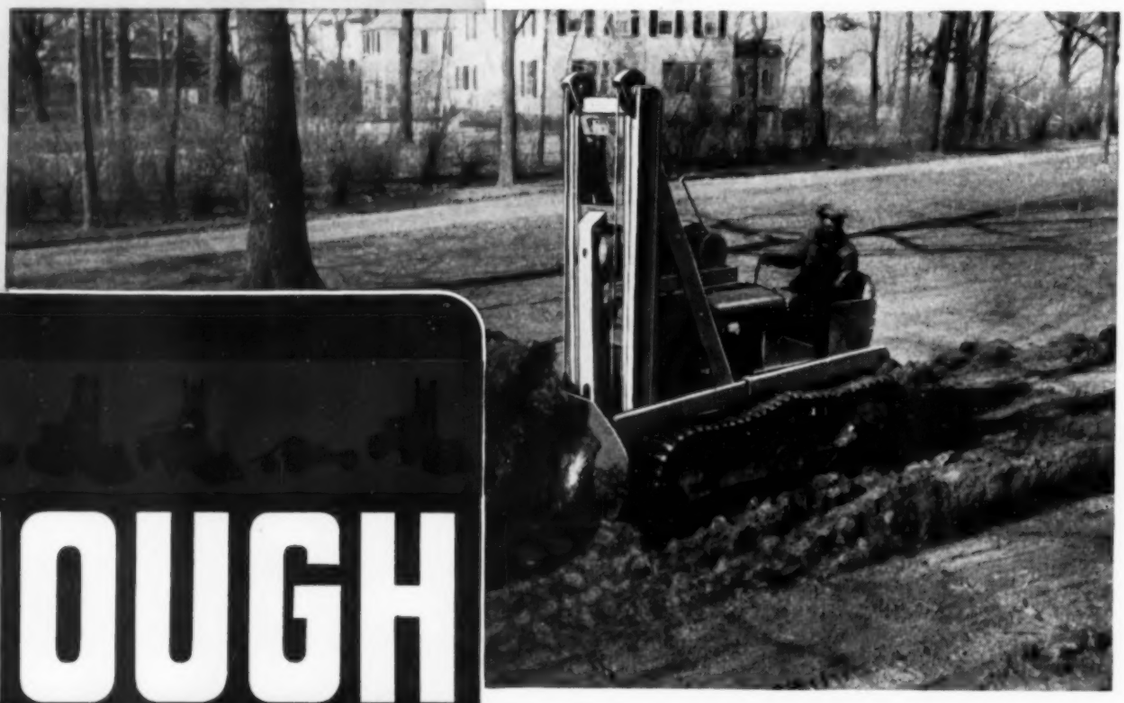
Lubricating Schedules For Today!

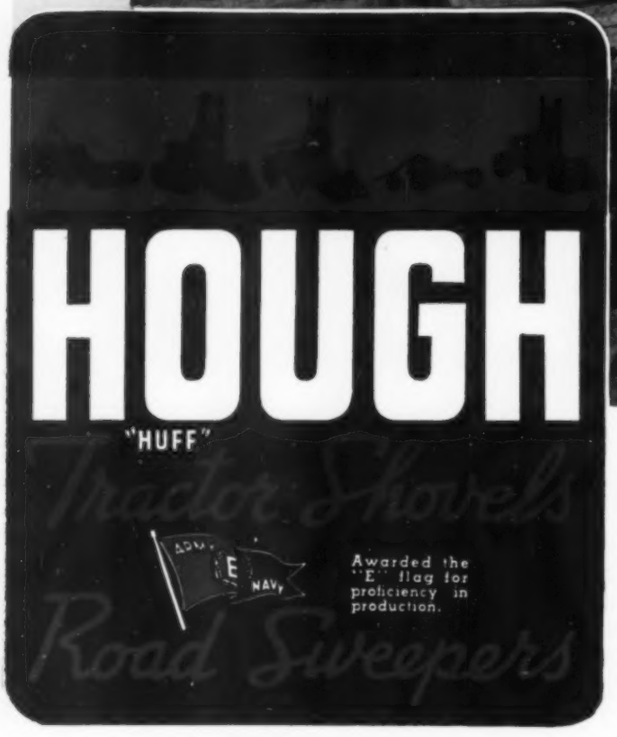
With new Hough Cable Operated Tractor Shovels difficult to procure, those in service are being operated far in excess of normal hours; which implies the need for greater lubrication and maintenance care. Hough equipment will function faithfully for long periods if proper maintenance practices are observed.

In the matter of lubrication, take a tip from the U. S. Engineers, whose *greasing period is eight hours instead of one day.* The crew finishing an eight hour shift lubricates all points indicated for "once a day" lubrication. At the end of the second eight hour shift, the crew going off duty lubricates all "once a day" points, and any "two day" points which may be shown. This schedule is carried out through multiples of eight hours to the equivalent of the period when the equipment should receive a general overhaul.

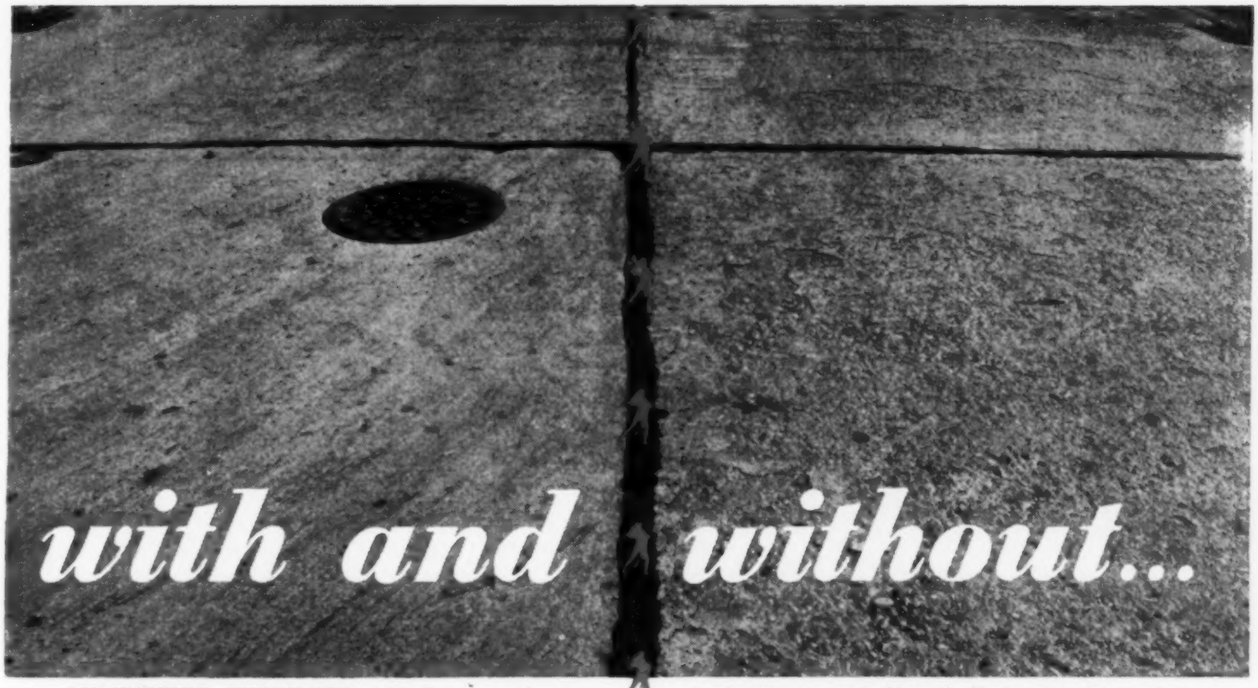
Use only clean SAE 10 oil (U. S. Engineers OE 10). Keep wear strip and guide frames well greased. Change the oil filter element frequently; flush hydraulic system every 400 hours.

If you treat your Hough Shovels right, they will serve you long and well. Can we help you with your operating and maintenance problems?

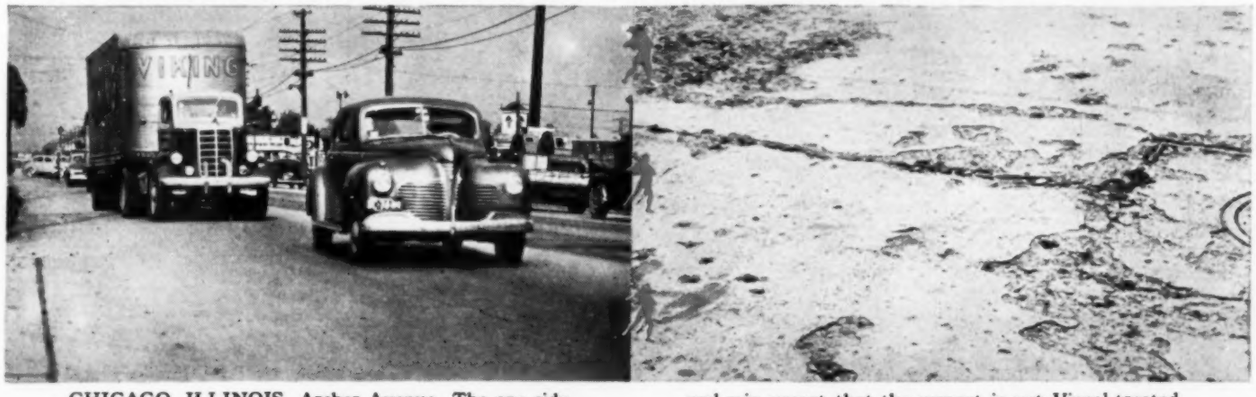




THE FRANK G. HOUGH CO.
Libertyville, Illinois
"Since 1920"

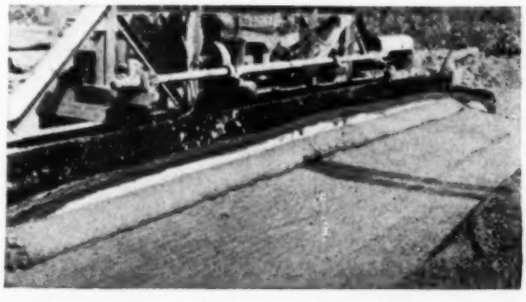


MILWAUKEE, WISCONSIN, 45th Street north of Capitol Drive. Area at left made with air-entraining portland cement. Right hand section is identical except that it did not contain Vinsol*. Notice that the concrete containing Vinsol is free of scaling; the other badly disintegrated. This is an actual, unretouched photograph.



CHICAGO, ILLINOIS, Archer Avenue. The one side (left) is made with air-entraining portland cement. The other side of Archer Avenue is of identical construction and mix except that the cement is not Vinsol-treated. Notice the dramatic difference in the above close-up picture of the non-Vinsol side.

AIR-ENTRAINING CEMENT MADE WITH VINSOL RESISTS SCALING



Finishing machine making second pass with air-entraining cement made with Vinsol. Note plasticity and uniform consistency. This means faster finishing.

*Reg. U. S. Pat. Off. by Hercules Powder Company

TEST ROADS like these have conclusively proved the scale resistance of Vinsol-treated portland cement. Vinsol-treated cement is today recognized in A.S.T.M. specifications; by the federal government; by many state highway departments. Write today for latest information, vital to everyone interested in concrete construction.

HERCULES

HERCULES POWDER COMPANY
INCORPORATED
NAVAL STORES DEPARTMENT
974 Market Street, Wilmington 99, Delaware

NV-40

"Make NO little PLANS"

The task is great . . . the incentive tremendous . . . the goal can be reached if sights are set high!

THE GOAL is a highway system based upon actual post-war needs. To make up for lost time, a doubled highway construction program will be necessary for at least three years. Actually, the program should be more than twice the pre-war size, because highway construction was far behind real needs when this nation entered the war. On the state systems, there is tremendous need for new construction . . . new and wider pavements, bridges, grade separations. In cities, the problems are equally acute. Supplementing the state systems and city streets is a vast network of county, township, and village roads totaling 2,400,000 miles, and serving 6,000,000 farms having an annual production of $12,000,000,000. Only a sound, planned construction program for these secondary roads can provide needed services, and eliminate exorbitant maintenance charges.

THE INCENTIVE is a post-war national economy with the full employment and high national income that exist when, and only when, construction activity is at a high level. All studies show that public works construction is essential to the nation's economic health. Being easily controllable, planned public works can be made to take up the slack in employment that is bound to occur in private construction.

Jobs must be waiting when the war is over . . . jobs for eight to ten million men in the armed services when they come home.

An adequate highway program guarantees large-scale employment, not only on roads and streets, but also in allied industries.

THE TASK facing the highway profession is that of providing for the full-sized post-war highway program that will meet the nation's economic needs. Great danger lies in the lack of realization of the size of the job to be done. The post-war program must be in BILLIONS if it is to fulfill its purpose, both in meeting the demands of traffic and sustaining its part in the national economy.

There must be a reservoir of highway projects of sufficient size to insure an annual program of three billion dollars. Every state, county, city, and regional area should have a program of highway construction *complete with plans, specifications, and cost-estimates.*

The post-war period will be a challenge to American ingenuity, and the highway profession will meet the challenge. But not with LITTLE plans. Little plans will not get rid of worn-out, obsolete roads and streets, unsafe bridges, and traffic congestion. Little plans will not build express highways between cities, or arterial routes into and through cities. Little plans will not provide the sound program, based upon the nation's economic needs and actual highway needs, which will pay dividends far beyond the cost. Make no LITTLE plans!

AUSTIN-WESTERN COMPANY
Aurora, Illinois

BUILDERS OF ROAD MACHINERY

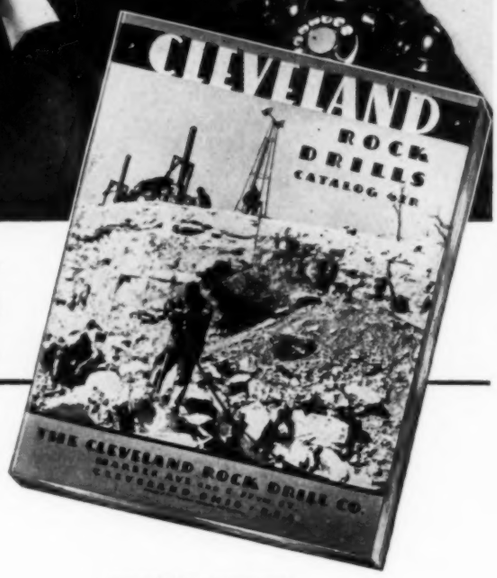
Austin Western

SINCE 1859

BUY MORE WAR BONDS

Use Rock Drills?

THEN WRITE FOR THE NEW Cleveland Catalog!



• Over 150 handsomely illustrated pages, describing Cleveland rock drilling equipment—you will find that and plenty more in our new Catalog 42R. Here are some of the subjects covered:

Detailed information about Cleveland Sinkers, Paving Breakers, Clay Diggers and Tampers, Drifters, Stopers, Wagon Drills and Accessories.

Helpful instructions, in cartoon style, about operating and maintaining Rock Drills.

Valuable information about getting more work out of your Paving Breakers.

Complete description of our other products, including Cleco pneumatic tools.

Write today for your free copy of Catalog 42R.

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The CLEVELAND ROCK DRILL CO.

Division of The Cleveland Pneumatic Tool Company

CABLE ADDRESS: "ROCKDRILL" • CLEVELAND 5, OHIO

LEADERS IN DRILLING EQUIPMENT

Try RING-FREE on your toughest jobs!

Cutting a secondary road is a tough job as every construction man knows. The equipment in the above photograph is lubricated by Macmillan RING-FREE, a tough Motor Oil for the toughest jobs.

RING-FREE "stays in there and takes punishment"... protects a hard-working engine with its ability to reduce friction *fast*. And Macmillan RING-FREE *removes carbon* while the engine runs! That helps many a piece of motorized equipment to better performance and longer life with less down time for repairs.

If you're having trouble with hard carbon, excessive wear, high fuel and oil consumption on your tough jobs, try Macmillan RING-FREE!

If you're "from Missouri", skip the soft spots . . . put Macmillan RING-FREE Motor Oil in the crankcase of the motorized equipment that is subject to your severest test! Here is what it does:

Macmillan RING-FREE Motor Oil *removes* carbon while the engine runs! The result is a cleaner, more thoroughly lubricated, sweeter running engine. And continued use of RING-FREE keeps carbon in check.

Furthermore, RING-FREE Motor Oil reduces friction *fast*! Internal engine friction is reduced to the extent that it's measurable in fuel savings as more power is delivered to the drive shaft. The fast penetrating quality, high film strength, high heat resistance and long cling to metal of Macmillan RING-FREE—contributing to reduction of friction—cuts down wear and repair. It pays to improve the performance and lengthen the life of all types of Diesel and gasoline engines with RING-FREE!

MACMILLAN PETROLEUM CORPORATION

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MACMILLAN RING-FREE MOTOR OIL

REDUCES WEAR BY REDUCING FRICTION

In war or peace
B.F.Goodrich
FIRST IN RUBBER

The tire that eats bullets

A typical example of B. F. Goodrich development in rubber

THOSE jagged holes were made by machine gun bullets that went right on through. But the tire didn't go flat!

It's a combat tire, used on army trucks, gun carriers, scout cars, and other vehicles which must travel under fire. While regular B. F. Goodrich truck tires were sturdy enough to take on most army jobs, they always went flat when hit by rifle and machine gun bullets. The army wanted tires that wouldn't.

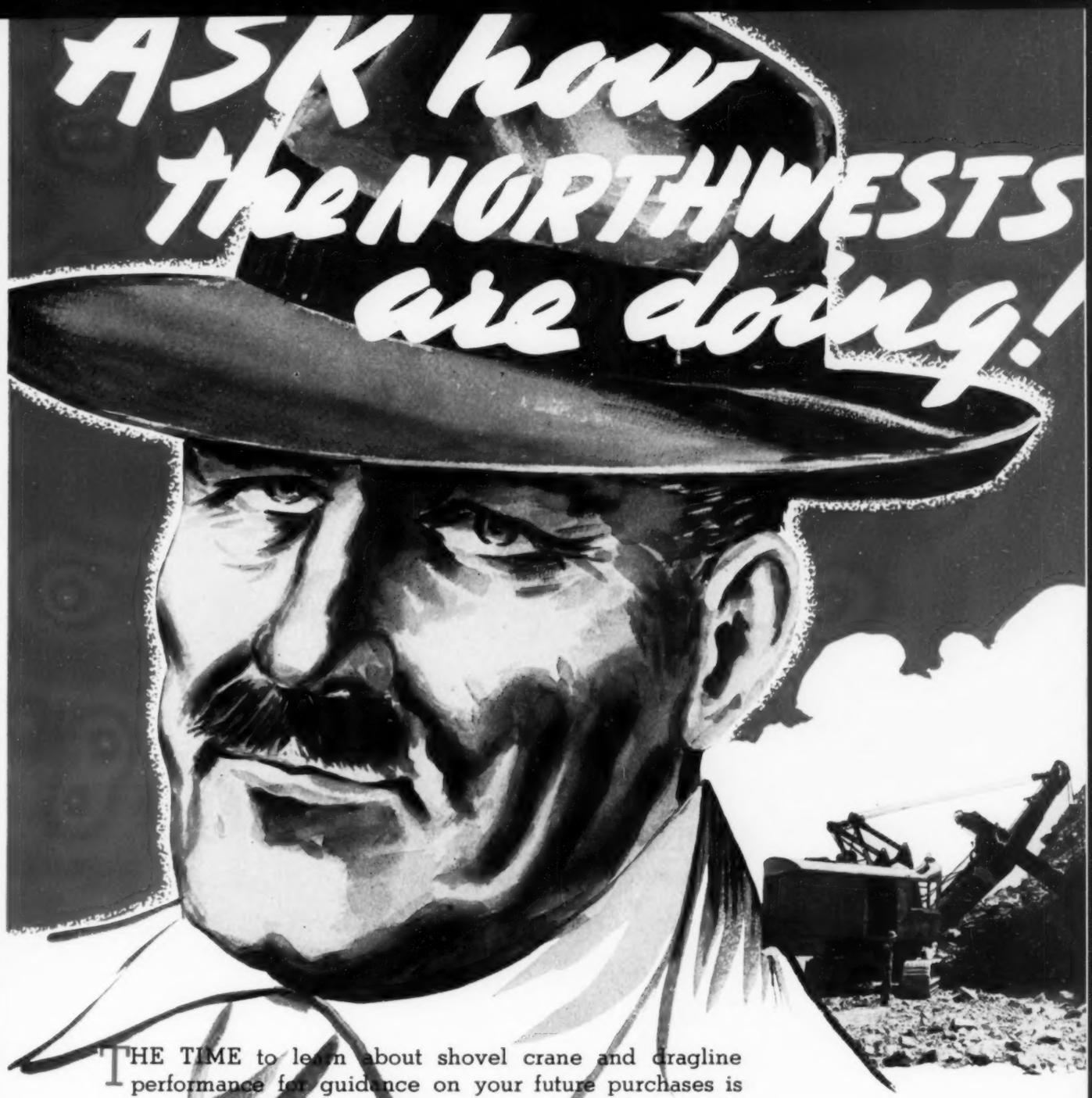
Rubber engineers working with military technicians developed a new kind of truck tire—a combat tire which had the ability to keep on running long after it was punctured. Combat tires, as made by B. F. Goodrich, have two lives. Under ordinary conditions the air in the tire carries the load, just as it does in any truck tire. When hit by a bullet, the extra-thick sidewalls take over the job. Even with air gone, the tire itself will support the load and run for 40 miles before going flat.

Because of the need for these special combat tires and other tires for military use, tires for civilian trucks and cars are scarce. Practically all tires being produced by B. F. Goodrich today are made wholly or partially of synthetic rubber. Those for passenger cars, with good care, will nearly equal the service of prewar tires. Truck tires are not yet as well perfected, particularly for intercity service, but are being improved. And they are keeping America's trucks rolling.

When next you buy truck tires, see the B. F. Goodrich dealer or Silvertown store.

B.F. Goodrich
Truck & Bus Tires

ASK how the NORTHWESTS are doing!



THE TIME to learn about shovel crane and dragline performance for guidance on your future purchases is right now! High pressure service—the "high ball" jobs of the war effort are a real test of equipment.

Ask how the Northwests are doing! You'll get an amazing story of trouble-free operation, low maintenance cost and dependability. More than ever before you'll learn the real reason why for years one out of every three Northwests has been a repeat order in the hands of leading contractors. Ask how Northwests are doing.

NORTHWEST ENGINEERING COMPANY

1728 Steger Building • 28 East Jackson Boulevard • Chicago 4, Illinois

-and when you have a real Rock Shovel you won't have to worry about output in dirt

NORTHWEST

SHOVELS • CRANES • DRAGLINES • PULLSHOVELS

ENGINES STAY CLEANER-

BEARINGS ARE SAFER!

YOU SAVE TIME—maintenance is simpler—when you use Delvac Oils in automotive Diesels and heavy-duty gasoline engines. These oils have remarkable properties: Effectively combat sludge formation! Resist to an extreme degree oil-oxidation products such as "varnish" and "lacquer"! Will not corrode hard-alloy bearings! RESULT: Far safer engines than with older-type oils.

OTHER SOCONY-VACUUM TIME-SAVERS:

MOBILUBE GEAR OILS for automotive use — Highly stable, straight mineral oils specially made for heavy-duty service. Free of abrasives, soaps, fillers, foreign materials of any kind—will not thicken excessively when cold. Excellent protection against "scuffing," dangerous wear!

MOBILUBE "V"—A special, short-fiber, soda soap grease developed primarily for wheel bearings and grease-type universal joints, but also recommended for clutch release bearings and other automotive parts operating at high temperatures. Remarkably efficient, long-lasting. Recommended for year-around use.

Talk with your Socony-Vacuum Representative

Mobilgas
SOCONY-VACUUM

USE SOCONY-VACUUM FUELS, LUBRICANTS, AND ENGINEERING SERVICE!

KEEP ENGINES "ON SCHEDULE" WITH SOCONY-VACUUM'S FAMOUS

DELVAC *Heavy-Duty* OILS

SOCONY-VACUUM OIL CO., INC., and Affiliates: Magnolia Petroleum Co., General Petroleum Corp. of Calif.

Here's One Underground Movement You Can Support!

After Hitler and Tojo are safely locked up in padded cells, America will have a chance to catch up on much needed construction work—new highways, new homes, new airports and the conversion of war plants to peace-time production.

The underground movement will be tremendous—there'll be need for more trench than would reach from here to Hell and gone. You'll be all set to cut yourself in on a piece of trenching profit with a fast, compact, rugged-but-not-overweight Buckeye Trencher. Rotary digging wheel and ladder types in sizes for every service.

Buckeyes are available under priority regulations—plan now for when they will be available to you—send for Trencher Catalog.

BUCKEYE TRACTION DITCHER CO.
FINDLAY, OHIO

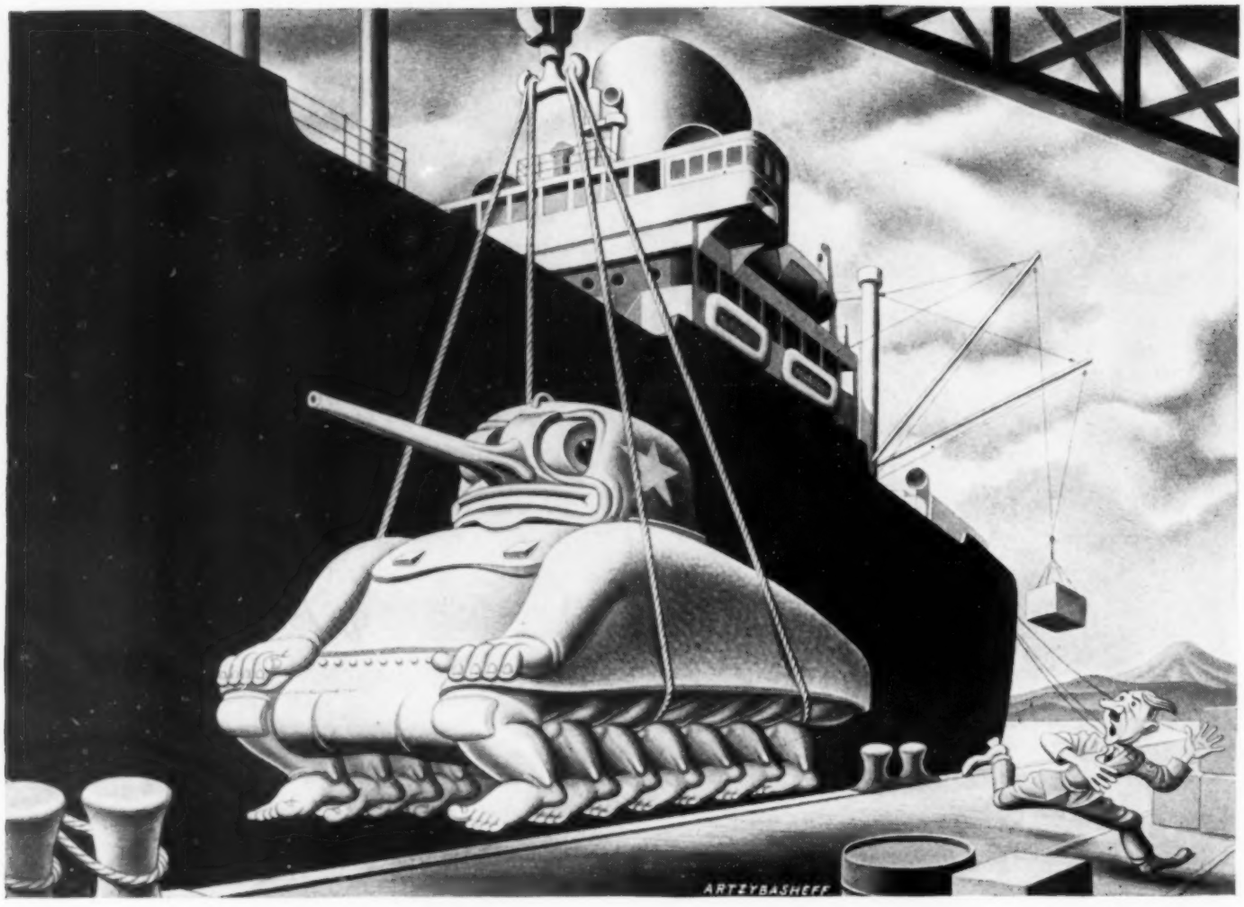
P E A C E
WILL BRING NEW CONCEPTS IN TRENCHING

The Air Age, ushered in by the war, calls for burial of much of the electric and telephone wire and cable formerly strung on poles—advanced methods in herringbone and lateral subgrade drainage of highways to protect the surface material—drainage to prevent soil erosion and to reclaim land—gas and city water made available to more homes—these are a few of the future trenching jobs awaiting Buckeyes.

See other Buckeye advertisement pg. 155

Built by **Buckeye**

Convertible Shovels Road Wideners Trenchers
Spreaders R-B Power Finegraders Tractor Equipment



Enlarged reproduction free on request

If this Tank could *talk*...

"Do you know this buddy of mine who's setting me ashore to start erasing Nazis? Let me tell you about him. I first learned what a stout, dependable friend Wickwire Rope is at the mine, where I was just red ore. Then he helped make some of my fine steel parts; and to build me . . . and dig wells for my fuel. In every industry, and on our Liberty Ships, you'll find friendly Wickwire Rope, serving silently and dependably. He'll be serving on the trip to Berlin, too."

• • •

For 122 years Wickwire Spencer has specialized in steel wire and wire products, pioneering many of the industry's important achievements. Wherever quality and service count, that name has won a reputation we aim to continue. Let Wickwire Spencer engineers help on *your* war production—and in your planning ahead.

WILL *YOU* HELP?
Every foot of famous WICKWIRE quality rope is needed to help in vital war production here at home, on the Victory Ships, and at the fronts. YOU can help by making the wire rope YOU use last longer.

FREE BOOK TELLS HOW

Its 82 pages contain:
78 pictures of right and wrong ways
41 wire rope life savers
20 diagrams, tables, graphs and charts

SEND FOR YOUR FREE COPY.

Send your wire rope questions to:

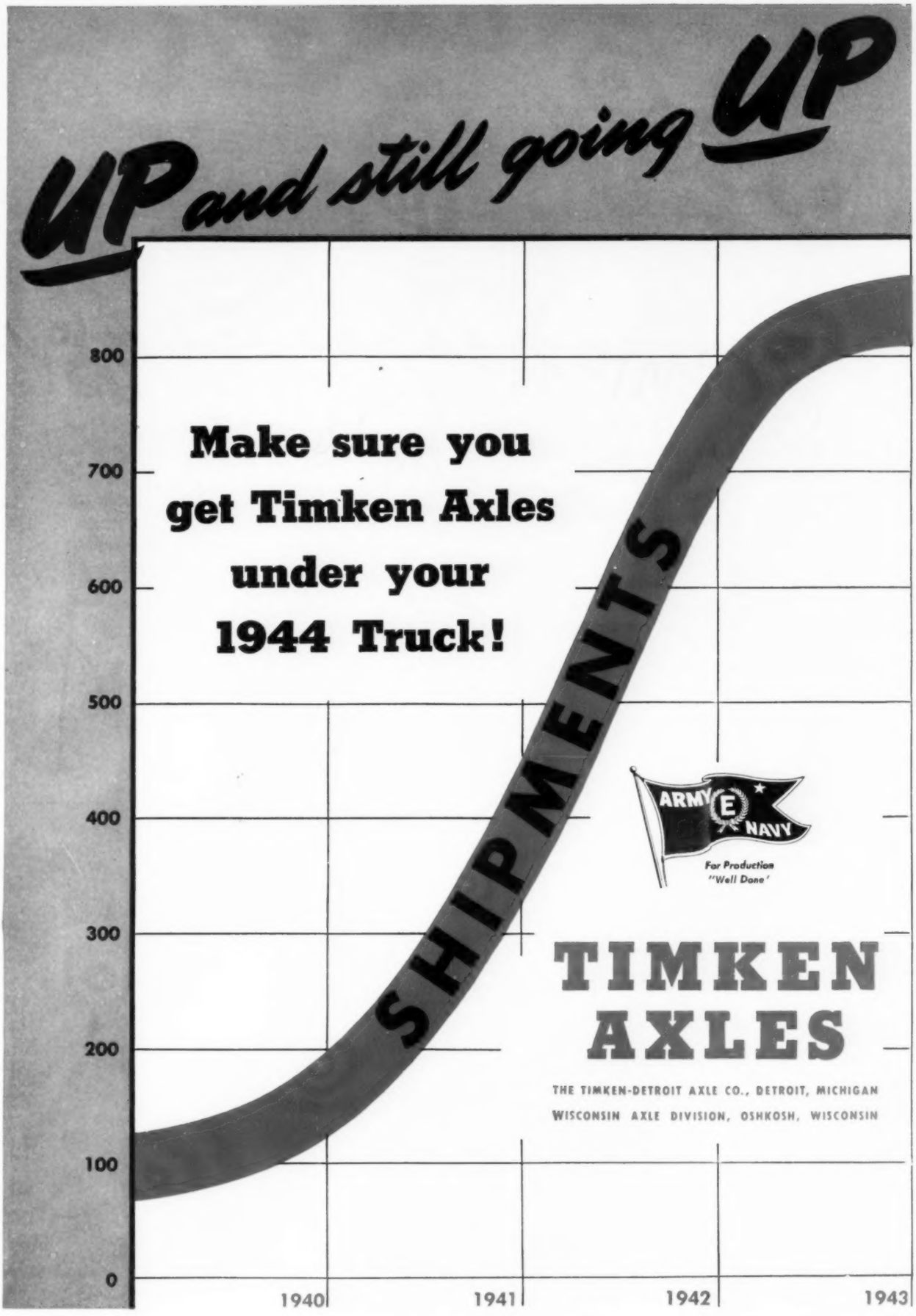
Copyright 1944, Wickwire Spencer Steel Co.

WICKWIRE SPENCER STEEL COMPANY

500 FIFTH AVENUE, NEW YORK 18, N. Y.

WS STANDS FOR FRIENDLINESS

Abilene • Buffalo • Chattanooga • Chicago • Detroit • Houston • Los Angeles • Philadelphia • San Francisco • Tulsa • Worcester


UP and still going UP
800
700
600
500
400
300
200
100
0
SHIPMENTS
1940
1941
1942
1943
Make sure you get Timken Axles under your 1944 Truck!
ARMY E NAVY
For Production "Well Done"
TIMKEN AXLES
THE TIMKEN-DETROIT AXLE CO., DETROIT, MICHIGAN
WISCONSIN AXLE DIVISION, OSHKOSH, WISCONSIN

"OLD GENERAL IRONGUTS"

Meet General Ironguts, the first General Excavator (shovel) ever built! For 17 years, this tough old baby has been in faithful service, moving several *million tons* of material. When war came, instead of retiring, "Old Ironguts" simply put on an oversize dipper and went to work in *rock* for the Scioto Lime and Stone Company, Delaware, Ohio. There you'll find the work-scarred old timer today, plugging away under the steady hand of Verne Andrew.

Says Verne, veteran of 25-years of shovel operation: "In the last year, we lost only a day's time because of 'Old Ironguts' being down for repairs and, as our General Manager, W. A. Reaney, can tell you, maintenance—and repair costs always have been extremely low."

Highlight History of "OLD GENERAL IRONGUTS"

Built in 1927 as a ½ yard rig

★

In continuous service since original purchase

★

Now equipped with ¾ yard dipper

★

Services a #7½ crusher plant with a daily output of 300 tons

★

Recently handled 20 truckloads (3½ tons per load) in 65 minutes

"Old General Ironguts," and its outstanding demonstration of the dependability of General Excavator equipment will be worth remembering when you can buy your next shovel.

The OSGOOD COMPANY
Sizes: ½ to 2½ Cu. Yd.
Diesel - Oil - Gas - Electric
Associated with The GENERAL EXCAVATOR CO.

The HERCULES COMPANY
HERCULES *IRONEROLLERS*
6 to 12 Tons
Diesel or Gasoline
Associated with The GENERAL EXCAVATOR CO.

GENERAL
Sizes: ⅜-½-⅝-¾ Cu. Yd.
Diesel — Gas — Electric
SHOVELS
DRAGLINES - CRANES
Crawler & Wheel Mounted
THE GENERAL EXCAVATOR COMPANY, Marion, Ohio

Nitro Starch Base

High Explosive Efficiency

IN MINING • QUARRYING • LOGGING AND CONSTRUCTION

Plus THREE ADVANTAGES FOR YOU!

WILL NOT PRODUCE HEADACHES from handling . . . reduces discomfort from breathing muck pile fumes. Better working conditions for you and your men!

WILL NOT FREEZE or leak at Arctic or Tropic temperatures. Maintained high efficiency . . . anywhere anytime!

WITHSTANDS IMPACT in high-powered Rifle Bullet Test. Greater safety for workers!

Today Trojan Products are helping our armed forces win through to Victory. We are proud to place our products at the disposal of our fighting men, with the fervent hope that they may help shorten the war . . . if only by a single day . . . so that we may once more utilize *all* our resources for *building* rather than *destroying* . . . so that we may serve America, and you, in the peacetime world "around the corner".

HELP SPEED THE PEACE . . . KEEP BUYING WAR BONDS

EXPLOSIVES 1905 TROJAN 1944 CHEMICALS

POWDER COMPANY

ONE OF AMERICA'S OLDEST HIGH EXPLOSIVES MANUFACTURERS

PLANTS: SEIPLE, PA. • ROBERT, CAL. • MAGAZINES STRATEGICALLY LOCATED THROUGHOUT THE NATION

OFFICES: ALLENTOWN, PA. • SAN FRANCISCO, CAL. • LOS ANGELES, CAL. • PORTLAND, ORE. • NEW YORK, N. Y.

Compensating

FINE and COARSE Material In Pit-run GRAVEL

FIRST STEP

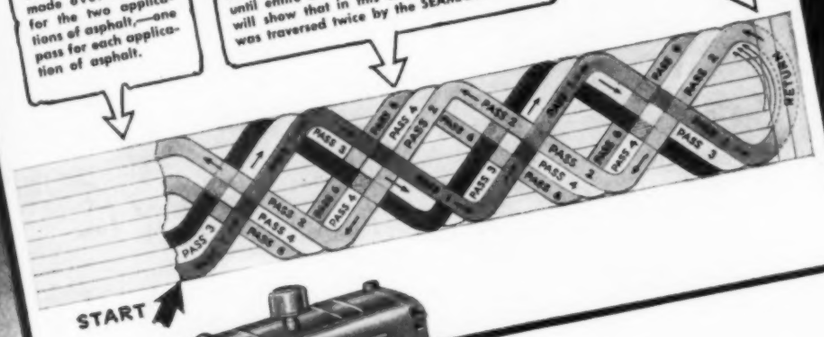
Mixing in longitudinal strips for the full length of the section to be stabilized. Two such passes were made over the area for the two applications of asphalt,—one pass for each application of asphalt.

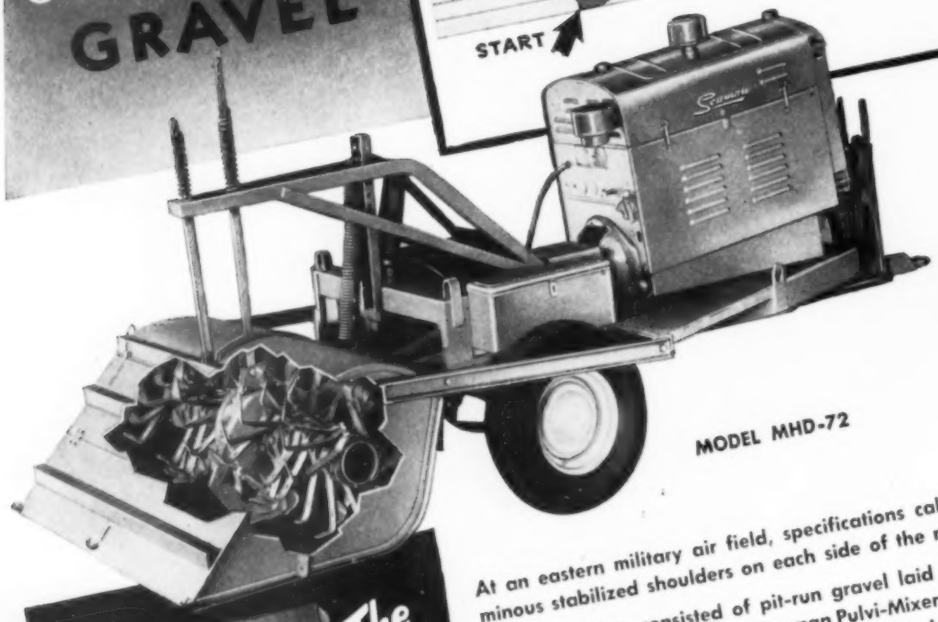
SECOND STEP

Mixing by operating the SEAMAN MIXER in a series of adjacent figure 8's. One operation (one figure 8) covers the field twice; — two directions. This blends fine and coarse strips of bank run material as well as blending rich and lean strips. The diagram below shows only six figure 8's, three trips out and three returning, — but this pattern was continued until entire area had been so treated. Study will show that in this way every square foot was traversed twice by the SEAMAN.

THIRD STEP

Corners at end of runway shoulder were mixed in transverse strips at right angles to the runway.





The SEAMAN PULVI MIXER

MODEL MHD-72

At an eastern military air field, specifications called for 75-foot bituminous stabilized shoulders on each side of the runways.

These shoulders consisted of pit-run gravel laid on primed sub-grade, and then mixed in-place with Seaman Pulvi-Mixers using MC-3 as binder. The gradation of the pit-run gravel varied, however, from sand to coarse material — a factor which would constantly change the oil requirement. To solve this, the SEAMAN MIXERS were operated in a series of Figure 8's or zig-zag courses of continuous cross-mixing. This blended lean strips of fines with the heavy black strips of coarse gravel as well as correcting gradation.

Moreover, — because of the leveling action of the SEAMAN MIXERS — longitudinal and lateral correction to grade became almost automatic during the in-place mixing operation. In spite of extra travel needed to correct the variation in the aggregate, — two SEAMAN MIXERS averaged approximately 20,000 square yards a day.

Just another tough problem made easy with the SEAMAN.

New! The 1944 Edition

If you would like to have a copy of the 1944 edition of "Soil Stabilization Methods", which covers the most recent developments in soil stabilization, write for Bulletin C-24.

SEAMAN MOTORS

MILWAUKEE • WISCONSIN

AFTER 2,000,000-LB. SQUEEZE

"TESTED to destruction," this 22" diameter concrete core withstood a pressure of 2 million pounds before giving way.

In your trucks, tractors, bulldozers, shovels, draglines, etc. bearing pressures are also high and require lubricants that will protect them. This is why contractors so definitely prefer *Texaco Marfak*.

Texaco Marfak provides ideal film lubrication inside a bearing, yet maintains its original consistency at the outer edges...sealing itself in, sealing out sand, dirt, water. Its tough, adhesive film cushions chassis parts against road shocks. Makes parts last longer.

For wheel bearings, use *Texaco Marfak Heavy Duty*...it stays in the bearings—off the brakes. Seasonal repacking no longer required.

Texaco Lubrication Engineering Service is available to you through more than 2300 distributing points in the 48 States. The Texas Company, 135 E. 42nd St., New York 17, N. Y.

THEY PREFER TEXACO

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

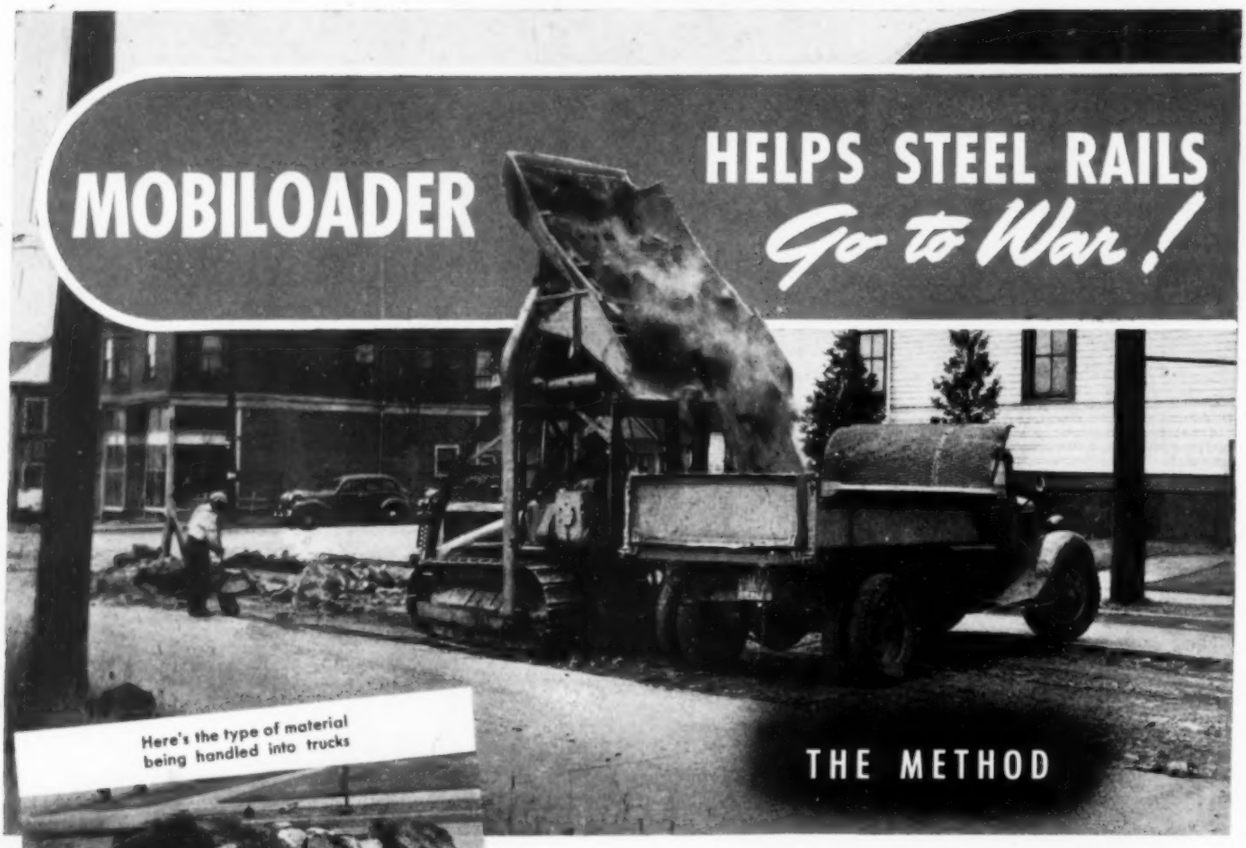
★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

TEXACO

TEXACO MARFAK

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

MOBILOADER HELPS STEEL RAILS *Go to War!*



Removing asphalt and bricks from streetcar right-of-way in Seattle after salvage of steel rails. Athey MobiLoader does the job of loading trucks--makes fast work of it!

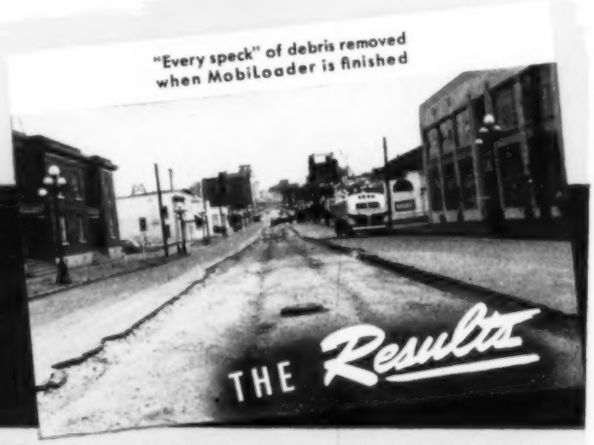
When the Northwest Construction Company of Seattle tackled their big contract to remove miles of steel rails from city streets, they turned over the important job of cleaning up debris from street surfaces to their Athey MobiLoader with exceptionally good results.

As the specially-designed rail-removing rig ripped up the salvaged steel for America's war machines, the Athey MobiLoader followed behind and loaded giant-sized asphalt slabs and pavement bricks from the right-of-way into trucks. The heavy material was hauled away at a fast clip and the clean strip, shown below, was all ready for the repaving crew to go to work.

The Athey MobiLoader, mounted on a "Caterpillar" Diesel Tractor, uses the simple overhead method of loading—travels forward to pick up, or dig, its load, goes in reverse to the truck or fill and discharges the material overhead. It's a fast, simple and highly useful mobile loading unit.

Used on a variety of stockpile and other loading jobs, it's speeding up production, replacing heavier, more expensive loading equipment and cutting loading costs.

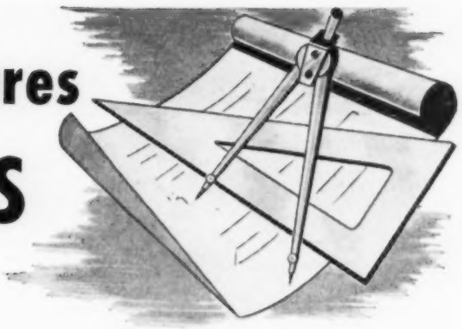
Your Athey-"Caterpillar" Dealer can supply any data you may wish pertaining to Athey MobiLoaders. He can also take excellent care of your equipment parts and repair needs. Athey Truss Wheel Co., 5631 W. 65th St., Chicago 38, Illinois.



Athey ★
MOBILOADERS

AMERICAN FREE ENTERPRISE CREATES PROSPERITY!

JAEGER offers these figures to POST-WAR PLANNERS



Compared with the last World War year of 1918, the placing and finishing of concrete highways and airports is now being accomplished ***6 to 10 times faster*** and at approximately ***one half the cost per yard.***

This progress, already achieved to meet war-time schedules, is directly due to the development by the paver industry of the dual drum paver and the development, by Jaeger-Lakewood, of the mechanical concrete spreader and finisher — ***the team that broke the bottleneck behind the paver.***

Planners of post-war projects and contractors who will build them will both be interested in the comparative figures offered below:

HIGH PRODUCTION: In 1918 an hourly rate of 40 lin. ft. of 18 ft. slab (80 sq. yds.) was fast work for a paver and Lakewood Finisher.

Today, runs of 300 ft. of 25 ft. slab (833 sq. yds.) per hour are being made by using two 34E dual drum pavers followed by one Jaeger Screw Spreader and one Jaeger-Lakewood Type "H" Finisher. On an Ohio glider base the pace of 314 ft. per hour was maintained for 17 hours, resulting in a single day's production of 5335 ft. of 25 ft. wide slab.

LONG LIFE: In 1918, from 30 to 40 miles of work wore out a finisher. Today's machine can do 150 to 200 miles in spite of much drier, harsher material, do 1,000,000 sq. yds. with the first set of screed shoes.

LOW COSTS: Comparing equipment costs, a contractor today can buy one 34E dual drum paver, Jaeger Finisher and Spreader for the price of two 1918 pavers and finishers and, with this single outfit, do 3 times the day's yardage possible with two 1918 outfits and crews. Finally, the cost per sq. yd. of pavement is approximately 50% lower — and the concrete is stronger, denser and far more uniform because mechanical handling permits dry vibratory mixtures and eliminates segregation.

THE JAEGER MACHINE COMPANY
800 Dublin Avenue **Columbus 16, Ohio**

JAEGER *Engineered* EQUIPMENT

ALSO "SPEEDLINE" MIXERS, "SURE-PRIME" PUMPS, "DUAL-MIX" TRUCK MIXERS, JAEGER HOISTS, "FLEET-FOOT" CRANE-LOADERS, "AIR-PLUS" PORTABLE COMPRESSORS

BACK OF EVERY ATTACK–

Preformed wire rope

A tiny torpedo boat races toward the enemy to deliver the kiss of death. A young skipper mans the wheel—and Preformed wire rope helps steer the craft over sub-infested waters.

The PT lets go its torpedoes. Then twists and dodges to keep out of enemy fire. And Preformed wire rope helps it get away.

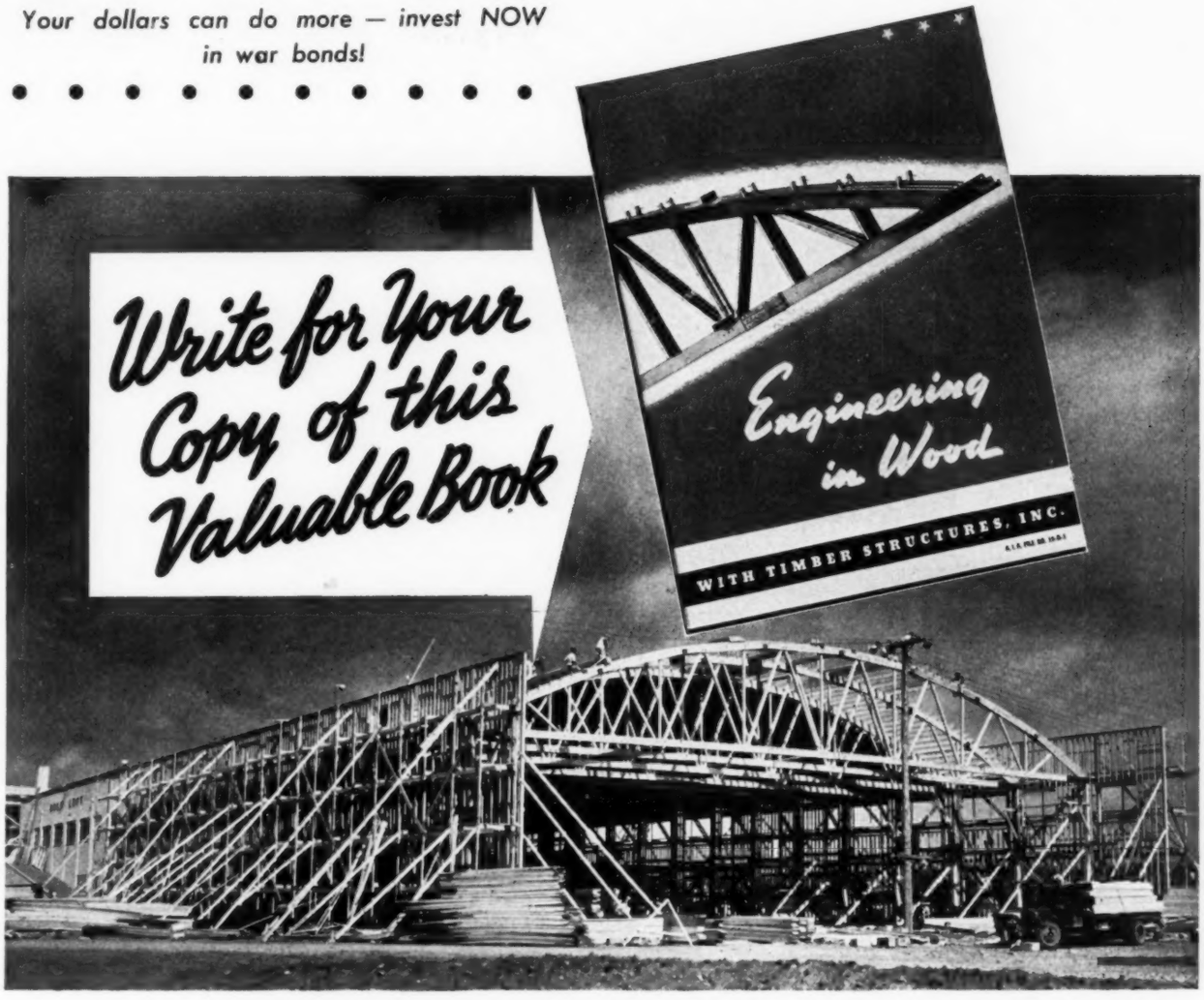
Where lives are at stake, Preformed has proved its superiority. That's why on PTs—it's Preformed.

Wherever the Allies attack, Preformed is on the job, proving its flexibility, its longer life—and its ability to save precious time.

That's why back of every attack—there's Preformed wire rope.

Ask your own wire rope manufacturer or supplier for Preformed wire rope

Your dollars can do more — invest NOW in war bonds!



48-PAGE PICTURE RECORD of typical jobs TIMBER STRUCTURES has done for AMERICAN INDUSTRY

"ENGINEERING IN WOOD" is a documented record of the importance of timber in building, and the type and kind of work performed by Timber Structures, Inc. for industry and government before and during the war.

The book is packed with photographic and word illustrations on the use of ring-connected timber trusses, columns, arches, and heavy framing in buildings ranging from small stores to huge industrial plants.

Examples have been chosen from these fields: Aviation, Bridges, Shipyards, Municipal, Industrial, Commercial, Specialties; with a special section on the techniques of Glued Lamination.

Contractors, architects, engineers and plant management men will find

- *"Engineering in Wood"* a worth-while addition to their reference and work files on current and post-war construction planing.
- For your free copy, simply fill in and mail the coupon or send a request on your letterhead.
- Prompt arrival of the book will be insured by addressing the Timber Structures office nearest you.

TIMBER STRUCTURES
INCORPORATED
ENGINEERING IN WOOD
Portland 8, Oregon New York 17, N. Y.

MAIL COUPON FOR LITERATURE

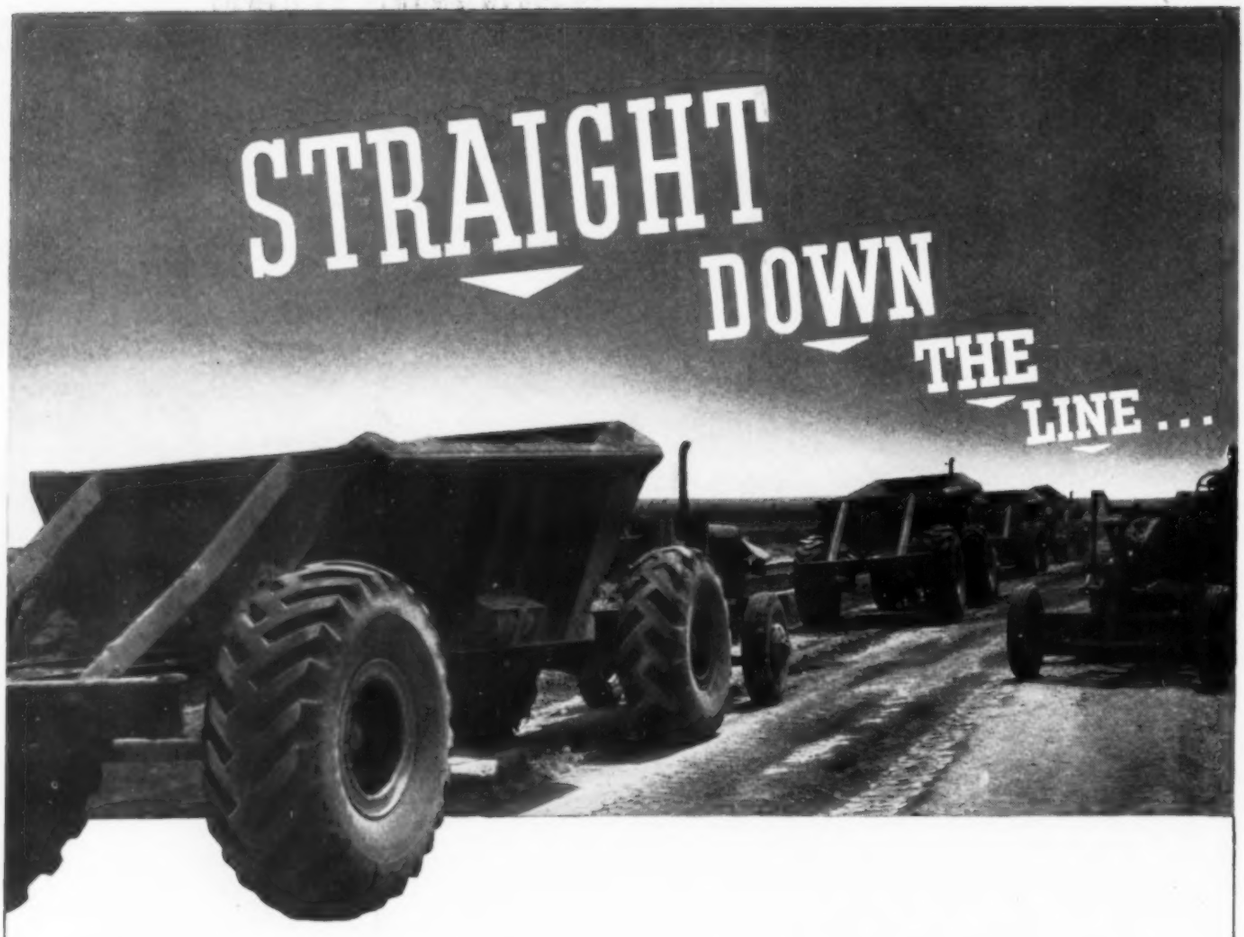
TIMBER STRUCTURES, Inc.
Send Book "Engineering in Wood"

Name _____

Address _____

Type of building or business . .

If *west* of the Mississippi, send to Portland 8, Oregon. If *east* of the Mississippi, send to 535 Fifth Avenue, New York 17, N. Y.



GULF QUALITY LUBRICANTS

reduce maintenance costs and insure maximum operating efficiency

Whatever type of mechanized equipment you are operating—it must have regular lubrication. And now, more than ever, it pays to use lubricating oils which provide an extra margin of protection to vital parts.

On job after job throughout the country, Gulf Quality Lubricants are being used "straight down the line". They are playing an enormously important part in keeping contracting equipment rolling under the most punishing conditions. They are *good insurance* against breakdowns and mechanical troubles.

This year make sure that *your* equipment gets the benefits of Gulf's higher quality lubricants. They are quickly available to you through more than 1200 warehouses located in 30 states from Maine to New Mexico. Write or phone your nearest Gulf office today.

Speed the Day of Victory — Buy More War Bonds

GULF

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH, PA

Over
TWO HUNDRED SIXTY-EIGHT THOUSAND TONS OF BALLAST IN SEVEN MONTHS for
STANDARD ASPHALT PAVING CO.
SPOKANE, WASH.
268256 Tons

Cedarapids

Built by IOWA

235,064 miles of railway line stretch across these United States and a large percentage of that track lies in Cedarapids crushed ballast. Keeping the war-loaded side-door pullmans and the troop-loaded polished cars rolling is an important war job and forms another part of the great story of what aggregate producing equipment manufacturers and the contractors using crushing equipment are doing.

It is not the outstanding or unusual record figures made under ideal conditions that deserve consideration. It is the day after day high average output figures that are typical of Cedarapids plant production that mean successful contracts and that should influence plans for future purchases.

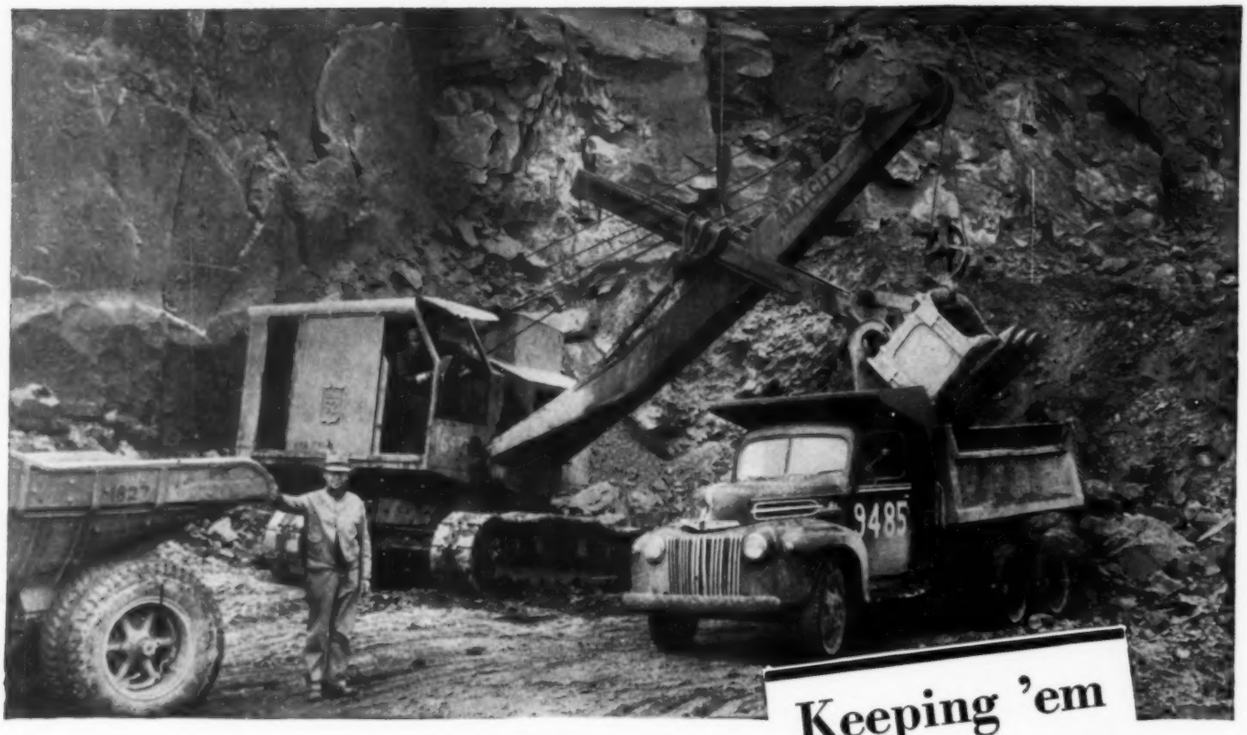
When you roll out 1000 to 1500 yds. day after day month after month and *depend on it*, then you *can really make plans* and know what you are doing. That's what Iowa equipment will mean to you on your postwar contracts.

Come to Headquarters for aggregate producing equipment.

THE IOWA LINE
of Material Handling Equipment Includes

ROCK AND GRAVEL CRUSHERS
BELT CONVEYORS — STEEL BINS
BUCKET ELEVATORS
VIBRATOR AND REVOLVING SCREENS
STRAIGHT LINE ROCK AND GRAVEL PLANTS
FEEDERS — TRAPS
PORTABLE PLACER MACHINES
PORTABLE POWER CONVEYORS
PORTABLE STONE PLANTS
PORTABLE GRAVEL PLANTS
REDUCTION CRUSHERS
BATCH TYPE ASPHALT PLANTS
TRAVELING (ROAD MIX) PLANTS
DRAG SCRAPER TANKS
WASHING PLANTS
TRACTOR-CRUSHER PLANTS
STEEL TRUCKS AND TRAILERS
KUBIT IMPACT BREAKERS

IOWA MANUFACTURING CO., CEDAR RAPIDS, IOWA

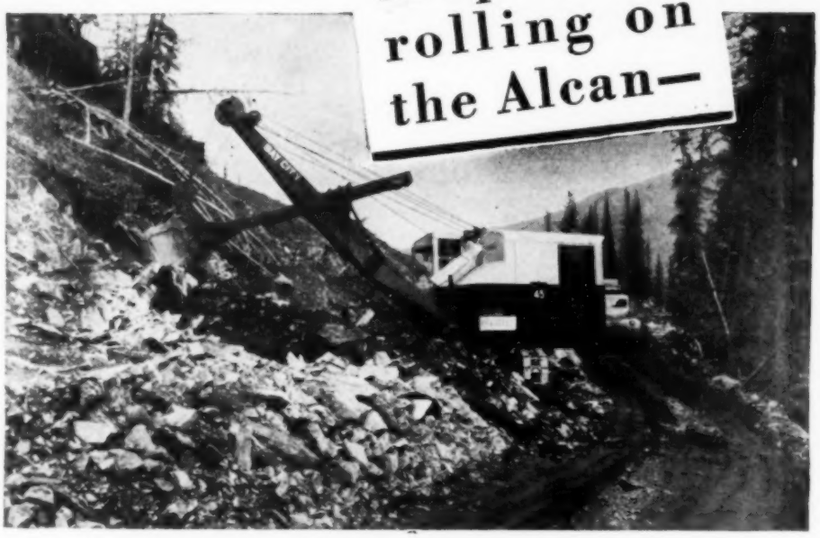


Keeping 'em rolling on the Alcan—

Your present equipment, working 'round-the-clock will last longer and continue to perform efficiently if these common-sense rules are followed:

- insure proper regular lubrication
- provide daily inspection to detect troubles while they are still small
- make adjustments when needed—don't wait
- tighten loose bolts and nuts
- keep fuel, lubricants and water clean
- remove clutch and brake bands and clean lining with good grade of clear gasoline
- change cables end-for-end to increase life of wire rope
- plan work to favor machine
- inspect engine regularly — flush radiator when dirty
- always give model and serial numbers when ordering repairs
- contact your BAY CITY distributor for parts and service.

. . . V—



The two BAY CITY Shovels shown here were drafted from civilian service to help keep trucks rolling on the Alcan Highway. They, like all new BAY CITY equipment, have signed up for the duration. This means your old machines, working on 'round-the-clock schedule must receive extra care and attention. The list (at left) may be helpful to your operator—give it to him. While BAY CITY convertible equipment is now going *only* to the Armed Services, we will gladly mail you catalogs so you will have them when considering your post-war requirements. Just write Bay City Shovels, Inc., Bay City, Michigan.

BAY CITY SHOVELS
12 Sizes
⅜ to 1½ Yard
Also truck mounted shovels and cranes

BAY CITY

SHOVELS • CRANES • DRAGLINES • TRENCH-HOES • SKIMMERS

With irreplaceable construction equipment taking a punishing war-time beating, efficient maintenance and speedy repairs are more vital than ever before. And *good service tools* count as never before! Snap-on tools are stand-outs for power, flexibility, speed . . . built to turn out more work and better work, with less effort and greater safety. The Snap-on line is complete, from smallest service tools to Extra Heavy Duty and Jumbo wrench sets. Snap-on's direct-to-user tool service is available through factory branches in 35 principal cities. *Write for catalog of the complete Snap-on line.*

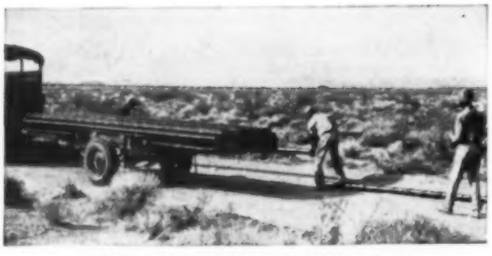
SNAP-ON TOOLS CORPORATION

8084-A 28TH AVENUE **KENOSHA, WISCONSIN**

Crew Laying Mobile Pipe Line—U. S. Army Photograph

GASOLINE *in a* DESERT?

That was one problem which confronted the Corps of Engineers as it planned for the supply of our mechanized equipment and our flyers with precious high-test gas. So was gasoline in a jungle. And gasoline on mountain-tops blasted flat for landing fields.



This is how Pipe is distributed—
U. S. Army Photograph

They knew that it was one thing to lay pipe lines through country where the route could be picked—but it is a very different matter when the location of an enemy force dictated the route our soldiers have to travel.

And the difficulties multiply vastly when an enemy force is located far inland, with only faintest trails through densest undergrowth to guide our troops.

It is under these circumstances—and worse, you can be sure—that Army pipe lines are being laid. Life-giving arteries winding through the wastes, bringing offensive power to our men, driving always forward, and forward some more.

Pipe is not a pipe line. A pumping station isn't either. Neither are the ingenious couplings which lock each length of pipe to its neighbor, and seal in the precious fluid brought so carefully from thousands of miles away by armed and convoyed tankers. No, none of these, by itself, is a pipe line. But altogether they are.

Is it any wonder the Engineer Board at Fort Belvoir, and the Office of the Chief of Engineers in Washington, studied so eagerly the early beginnings of automatic pipe lines established in this country by private industries? Or so quickly adapted and redesigned these early beginnings into the simple, quickly assembled, fast, efficient, portable pipe lines now in use in every theatre of war?

Numerous companies co-operated with the Corps of Engineers in these original studies; and are now co-operating in the supply of needed components. We are proud to have been associated with the project from its earliest inception by the Corps of Engineers.

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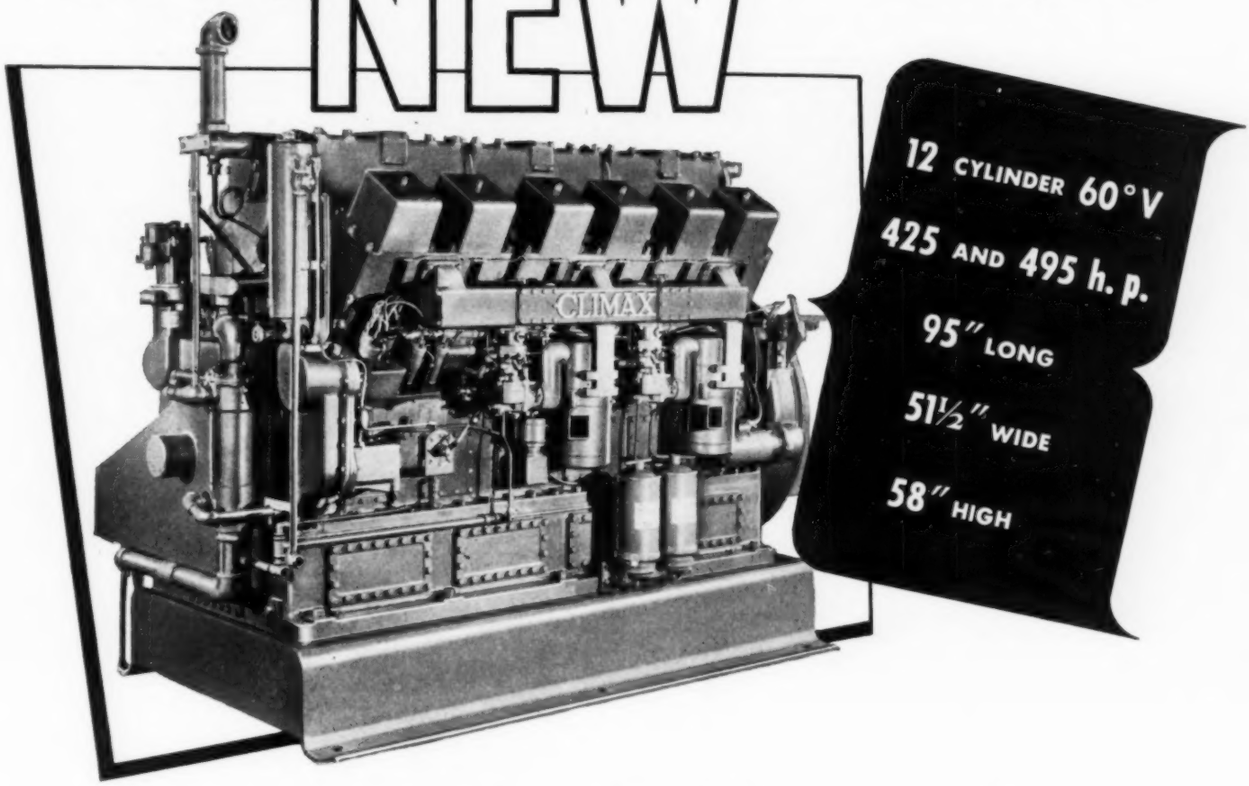
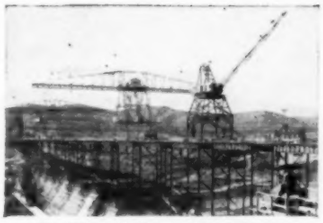
Something NEW in Gas Engines

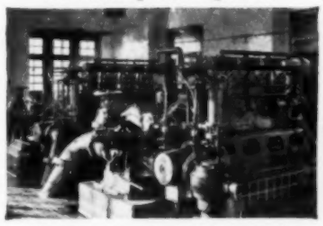


. . . for Construction Machinery and Stationary Power Applications



Use Climax V 12 for any stationary or mobile construction power.

Climax V 12 provides ample power for deep oil well drilling and mining service.



Climax V 12 is a heavy duty engine for all stationary power applications.

The Climax V 12 is a new type heavy duty engine, expressly built for construction and industrial service. It is ideal for direct connection to compressors, pumps, crushers and mill drives. With an AC or DC generator, it will produce low cost electricity up to 312 KVA.

This compact V type power plant provides that smooth flow of abundant power possible only from a 12 cylinder engine. Because it generates power from natural gas, butane, propane, distillate, gasoline or other mixtures, the V 12 possesses an operating flexibility unknown in single fuel prime movers. It starts as easily as an automobile engine and can be operated over a wide speed range without encountering criticals.

The engine is simply designed and easy to operate. No specially trained mechanics are needed for either maintenance or repairs.

SEND for Climax Engine Bulletin No. S 329, which contains specifications, performance curves, drawings and dimensions and complete description of the V 12.

"For High Achievement in the Production of War Material"

Climax Engineering Company

GENERAL OFFICES & FACTORY: CLINTON, IOWA

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Official U. S. Army Signal Corps Photograph

AIR ALERT *over there* relies on alertness *here!* To keep *CONSTRUCTION* equipment in continuous operation on wartime schedules use . . .

SINCLAIR PENNSYLVANIA and OPALINE MOTOR OILS, specialized gear oils and greases. These lubricants give *safe* lubrication under all loads and speeds . . . prevent avoidable shut-downs . . . reduce repair and replacement costs.

(Write for "The Service Factor"—published periodically and devoted to the solution of lubricating problems.)

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FOR FULL INFORMATION OR LUBRICATION COUNSEL *WRITE* SINCLAIR REFINING COMPANY (INC.), 630 FIFTH AVENUE, NEW YORK 20, N. Y.

First Place

IN PLACING PERFORMANCE

2,000,000 square yards of concrete . . . the equivalent of 180 miles of 20-foot road, and still going strong . . . that's the record of one Rex double drum paver. This exceptional concrete placing performance is typical of Rex pavers. For consistent, high production yardage performance . . . built-in stamina and ruggedness for the toughest jobs . . . Rex 34E double drum pavers are the leaders in the paving field.

In the Rex 34E, the batch transfer and entire mixing cycle are automatically controlled to the split second by the famous Rex Mechanical Man . . . a feature that eliminates expensive wasted seconds. And the roomy, clear vision operating deck makes for ease of operation and faster job progress. The extended crawlers provide stability and allow the boom and bucket to be swung at right angles to the machine without tipping.

For complete information on Rex Pavers and how they can help speed your jobs, send for your free copy of Bulletin 407. And check the other Rex construction equipment: Moto-Mixers, to speed the mixing, hauling and placing of concrete . . . Pumpcretes, the pumps that pump concrete by pipe line . . . Pumps that move water economically and efficiently . . . Mixers that cut concrete mixing costs. See your Rex Distributor or write Chain Belt Company, 1664 West Bruce Street, Milwaukee 4, Wisconsin.

CHAIN BELT COMPANY
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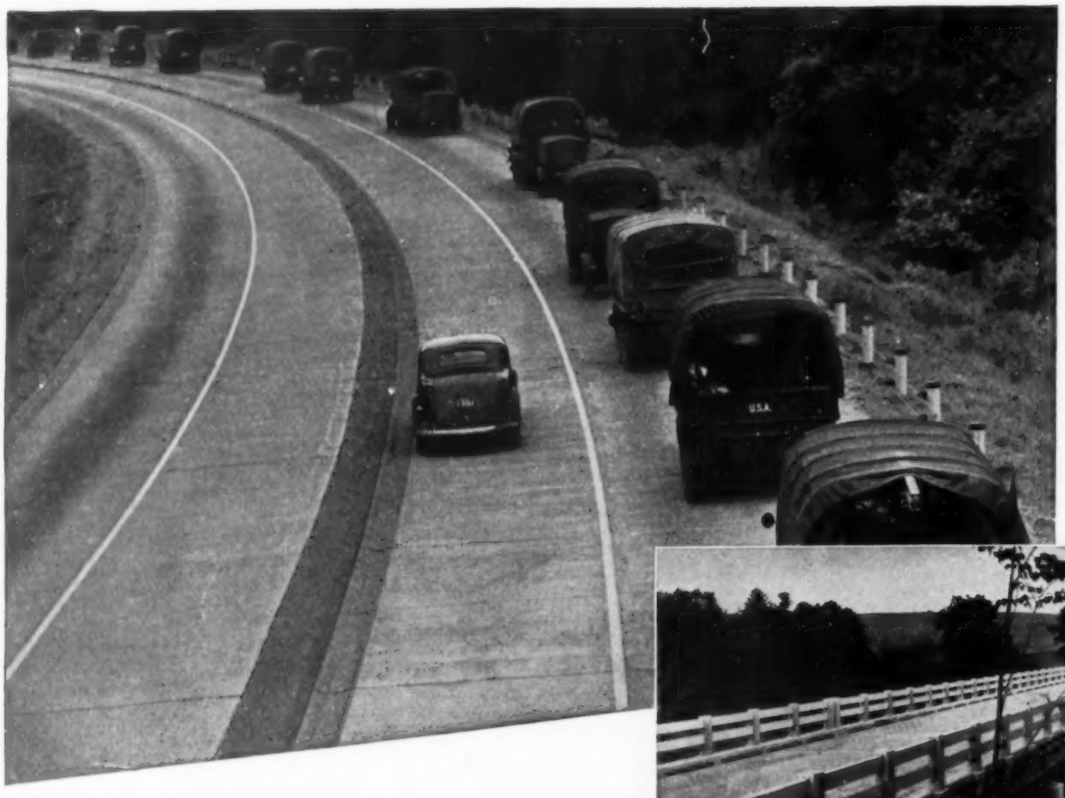
REX

CONSTRUCTION MACHINERY



WHEN ROAD JOBS ARE RUSH JOBS

Lehigh CEMENT

. . . USE LEHIGH EARLY STRENGTH CEMENT

When you complete a road contract ahead of schedule, you save more than days and dollars. You eliminate delays and detours, avoid extra travel and trouble for users of the road. And that saves gasoline, oil and tires.

So it's *patriotic* as well as profitable to use Lehigh Early Strength Cement. In 24 to 48 hours, it gives you concrete as strong as week-old concrete made with normal cement.

YOU KNOW WHAT THAT MEANS!

You can often move equipment over the new concrete in 24 hours!

Hazards are reduced when traffic must be maintained along the route.

Intersections can be opened sooner, reducing delays and detours.

Roads can be kept open all during construction by paving half-at-a-time with quick-use concrete.

To you, Mr. Contractor, all this means more efficient and more economical use of your labor and equipment . . . and more good will from the people you serve.

On your next paving contract, let our Service Department *prove* that Lehigh Early Strength Cement *can* help you do the kind of fine, fast job that cuts your costs and brings you more business!

LEHIGH EARLY STRENGTH CEMENT
for **service-strength** concrete in a **hurry**

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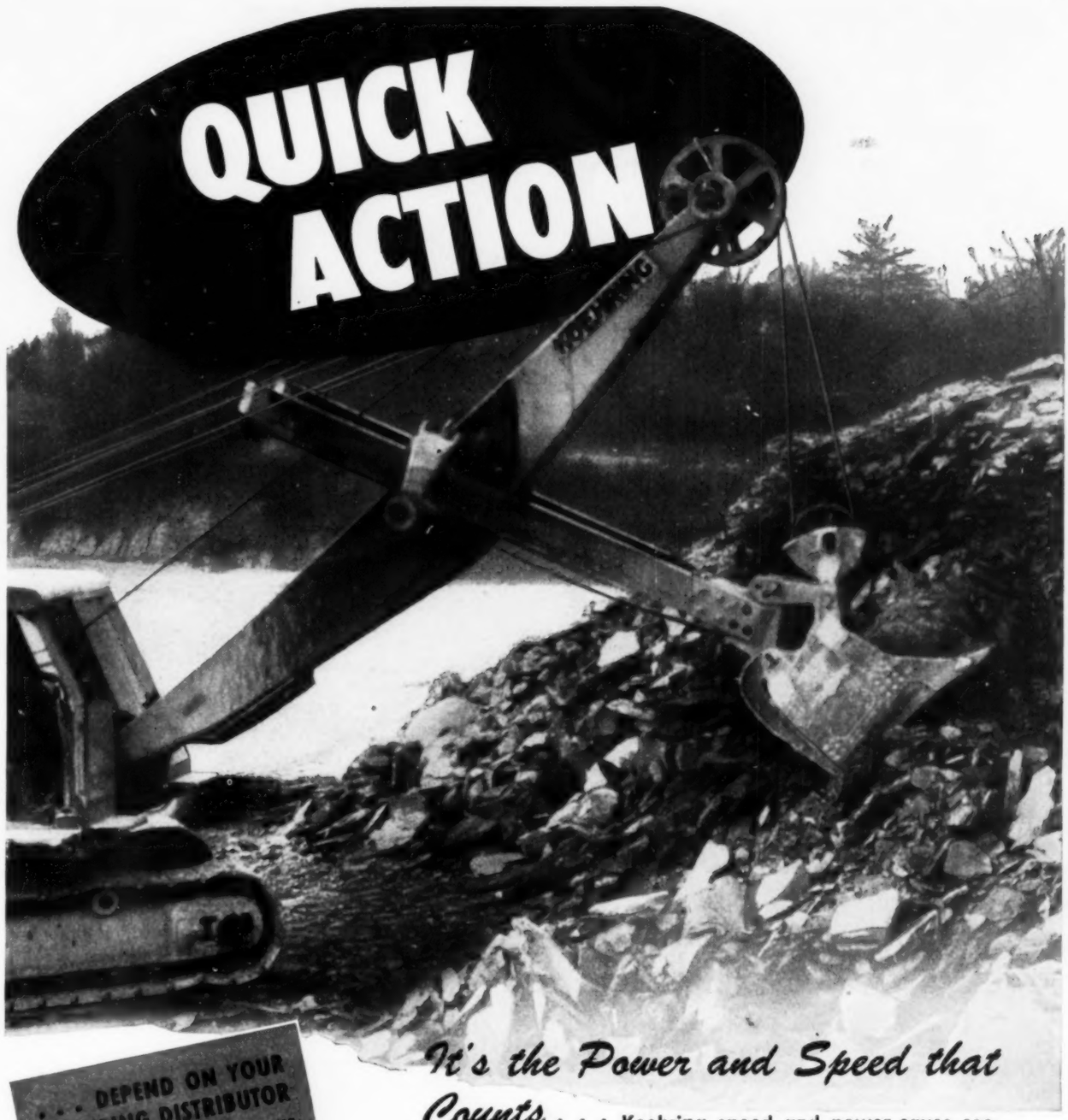


. . . DEPEND ON YOUR KOEHRING DISTRIBUTOR to help you keep your equipment operating. Care for your Koehring equipment NOW, so it will serve you tomorrow. Koehring distributors have genuine Koehring parts. Koehring parts warehouses are at your service.

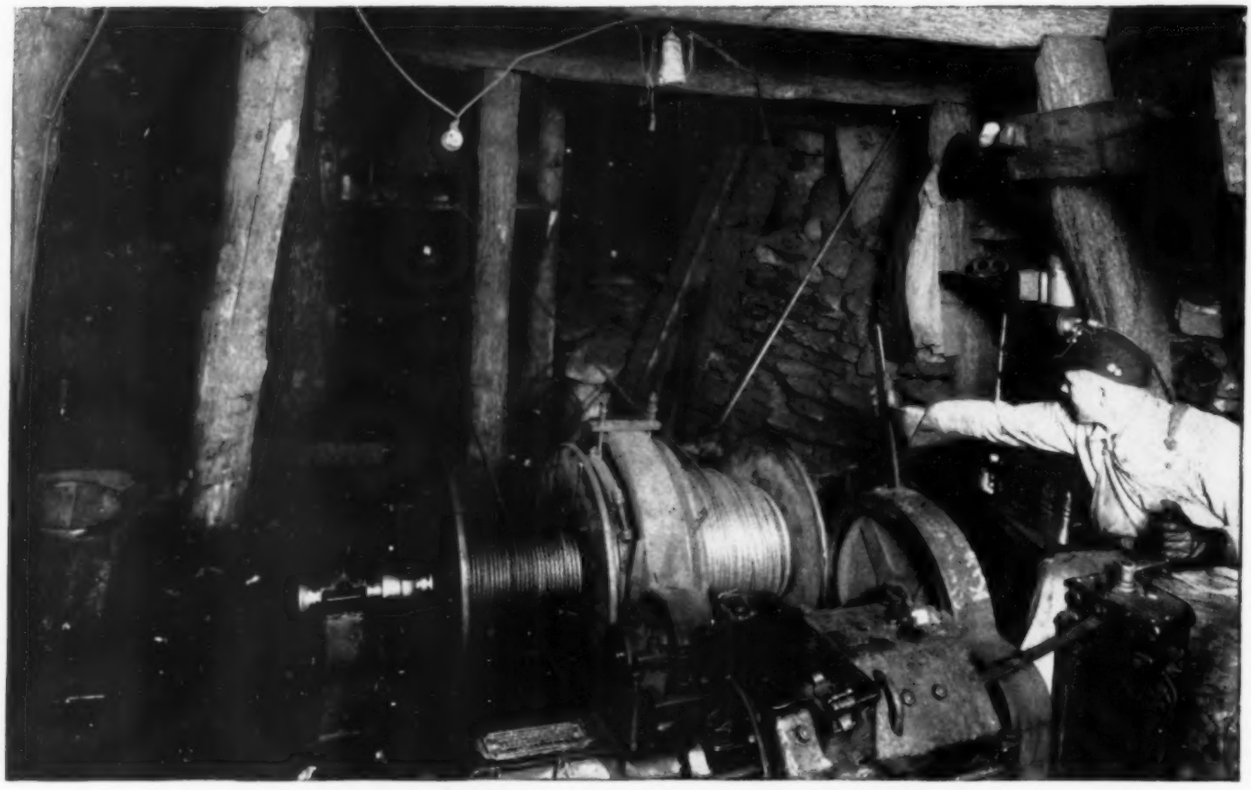
It's the Power and Speed that Counts . . . Koehring speed and power saves seconds in shovel operations . . . the surest way to increase production. Victory demands a greater output, and Koehring Shovels have the reserve power to provide it. The wartime service needed is available in your Koehring Shovel with little time out for breakdown or repair. Be sure to keep your shovel well lubricated . . . replace worn parts before failure . . . never misuse your shovel in any way . . . and it will exhibit a performance that counts in increasing production.

KOEHRING HEAVY DUTY

ARMY E NAVY

KOEHRING COMPANY *Milwaukee 10, Wisconsin*

HEAVY-DUTY CONSTRUCTION EQUIPMENT



A WAR MESSAGE...

To The Man Behind The Throttle

Wartime calls for extra deftness in your throttle hand. Not only is it vital to the war effort to get more work out of your machine but at the same time do it with the least wear and tear.

Wire Rope especially must be given every possible care in order to last just as long as it possibly will. The chance of replacing wire rope is apt to continue limited. Great quantities of it still must be produced for our armed forces. As our offensive power gains momentum and invasions increase in number and scope, the greater becomes the tonnage of war materiel which must be hoisted, handled, loaded and unloaded all around the globe.

In the white heat of battle when lives depend upon it, wire rope must take abuse necessitating replacement long before its time. So it is that the important matter of conserving wire rope falls heavily on the throttle hand of users on the home front. To help you save wear and tear on your wire rope and keep it working, Union Wire Rope engineers have prepared and offer five different booklets entitled: ***1. Correct Handling of Wire Rope. 2. Lubrication of Wire Rope. 3. Splicing Wire Rope. 4. Socketing Wire Rope.*** These give you specialized information. ***5. Rope Dope*** amplifies on abuses of wire rope and the remedies. All are written in non-technical terms. Put into practice, the information contained in these booklets will help you contribute to the war effort now by conserving wire rope and it should stand you in good stead in safer and more satisfactory wire rope operation post-war. All are FREE for the asking. A penny post card request will bring any or all of the booklets.

FREE

CORRECT HANDLING OF WIRE ROPE	SOCKETING WIRE ROPE	SPLICING WIRE ROPE	WIRE ROPE LUBRICATION	ROPE DOPE

UNION WIRE ROPE CORPORATION, 2160 Manchester Ave., KANSAS CITY 3, MO.
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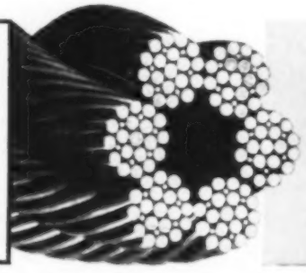
For Two Years of Team-work with Our Armed Forces

WHEN YOU NEED PREFORMED WIRE ROPE SPECIFY **union-formed**



union *Wire Rope*

"THE ULTIMATE IN LOW COST WIRE ROPE"

War birds settling home with bomb bays empty; truck transport, rolling from city to city heavy laden with war goods; both roll over smooth concrete, probably MultiFoote laid because there are more MultiFoote pavers in service than any other make.

From India to Alaska MultiFoote pavers are pouring out the concrete for war birds nests, highways for war transport, igloos for ordnance storage.

MultiFoote pavers are both wartime and peacetime tested for building the roads of tomorrow.

Check the pavers you see at work on the job, in pictures, anywhere at all! Notice that they are predominantly MultiFootes. Here is practical assurance that MultiFoote pavers will give you the kind of service you want after the "Duration." We will be glad to furnish any details you need for future planning.

Ewing Galloway Photo

ADNUN BLACK TOP PAVER

THE FOOTE CO., INC.
NUNDA, NEW YORK

MULTIFOOTE
CONCRETE PAVERS

USE YOUR SHOVEL'S "Second Wind" TO GET GREATER YARDAGE

● Tap that reserve capacity of your excavator. Every extra yard that can be produced beyond normal expectation is an added contribution to victory on the production front.

Good planning and job organization of course are "musts." So is proper maintenance of your equipment. And, equally important, an experienced operator through skillful handling of his machine can save a minute here and a minute there which add up to a substantial yardage bonus at the end of the shift.

Perhaps these suggestions may help you to speed up your shovel's output:

Heap the dipper. Get a full load every pass. Heap every truck but don't overload.

●

Take a thin slice at a cut. Dipper will hoist through the bank faster and more easily than if you try for a deep cut. Take cut out in layers across face of bank.

●

Use two truck spotting wherever possible. Spot trucks in line with arc of swing and spot them the same distance from center of rotation.

●

Keep close to your digging — don't "stretch" to reach it. Spot trucks so as to dig and dump at same radius. Move up while waiting for trucks.

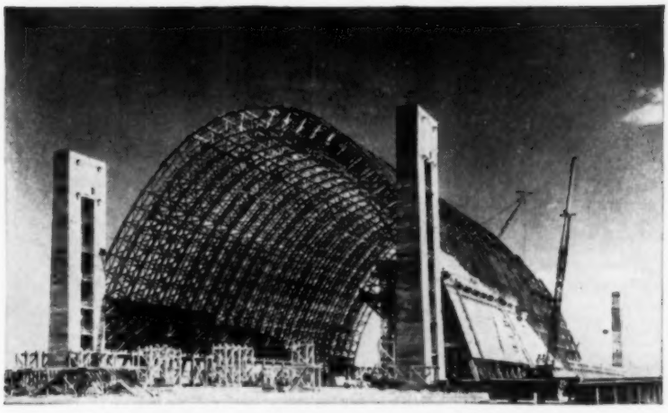
Work for smooth, well-balanced operation in a close tie-in with the flow of trucks. Steady operation is what breaks output records and gets out big yardage.

Bucyrus-Erie

SOUTH MILWAUKEE, WISCONSIN, U. S. A.

Timber Hangars for the Navy's war planes.

THE NAVY BUILDS WITH WOOD



Blimp Dock. The world's largest clear span timber structure recently completed by the Navy. 1000 feet long, 153 feet high, clear spanning 237 feet.

Since Pearl Harbor, the U. S. Navy has used over 2,000,000,000 feet of lumber and timber as a structural material at home and overseas bases.

This spectacular use of lumber and the Navy's wide application of the Teco System of Timber Construction have advanced the science of timber engineering. You, too, may have the advantages of timber construction. . . . . strength, economy and permanence . . . . now and in peacetime.

Here is sound engineering advice . . . . . *Design* in timber . . . . *Specify* Teco Connectors . . . . *Employ* a Teco Timber Fabricator.

TIMBER ENGINEERING COMPANY
Washington Chicago Minneapolis
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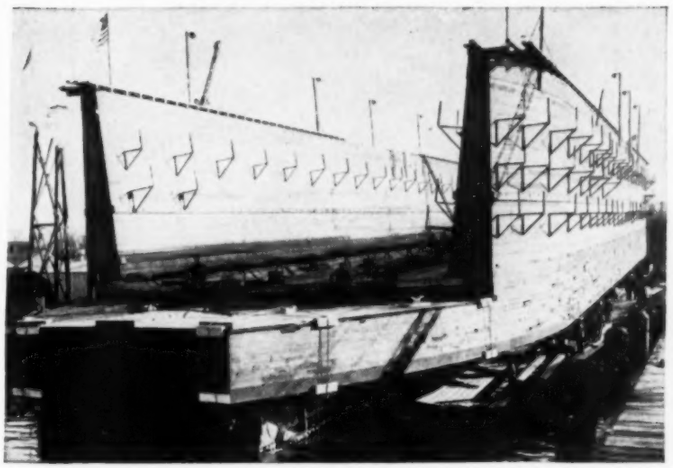

Floating Drydock. Timber connectored structure for vessel repair at sea.

FREE PICTORIAL BOOK

The story in pictures of the Navy's spectacular use of lumber and timber 'round the world.

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Please send me by return mail a Free copy of "BUILDING for BATTLE—With the United States Navy"

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CONNECTORS AND TOOLS

ENDORSED BY LEADING LUMBER MANUFACTURERS AND FABRICATORS.

The Difference is Greater Than Ever Today!

UNDER wartime conditions, experience counts more than ever before in building off-the-road tires to handle the big jobs.

Into the building of Goodyear tires goes the experience gained in producing more than 350,000,000 pneumatic tires — millions more than any other manufacturer has turned out.

It is this extensive "know-how," combined with such exclusive Goodyear features as multiple compounding, low stretch Supertwist cord carcass and Goodyear's three great time-proved tread designs that give Goodyear off-the-road tires a bigger quality edge than ever before today.

Add to this the fact that Goodyears are built with the maximum amount of new live rubber allowed by the government, and it's easy to see why Goodyears are far and away your best buy today. Remember, there's a reason why "more tons are hauled on Goodyear tires than on any other kind!"

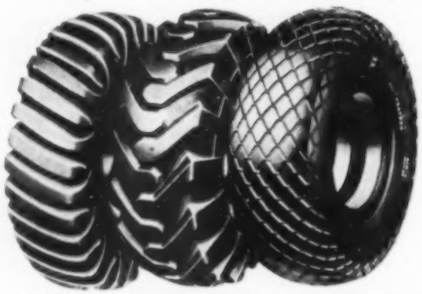
. . .

It's a MUST manual for wartime contractors—SEND FOR FREE COPY—*Goodyear's Off-the-Road Tire Manual tells you what you need to know about getting the most wear out of your tires. To get your free copy of this fact-filled service handbook on proper tire care and maintenance, write Goodyear, Dept. SP, Akron 16, Ohio.*

Goodyear's sound slide film on truck tire conservation is available for showings to group meetings of your drivers and maintenance men. Your Goodyear dealer or serviceman will be delighted to show it to your employes. Ask him about it.

Supertwist, Sure-Grip, All-Weather — T.M.'s The Goodyear Tire & Rubber Company

The Right Tire for Every Job



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GOODYEAR **SURE-GRIP GRADER** for mud and marsh

GOODYEAR **ALL-WEATHER EARTH-MOVER** for drawn dirt-movers

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THE GREATEST NAME IN RUBBER

Let's all **Back the Attack with War Bonds**

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Construction Methods

ROBERT K. TOMLIN, Editor

Volume 26 — FEBRUARY, 1944 — Number 2

LIEUT. GEN. BREHON B. SOMERVELL. Chief, Army Service Forces, winner of Moles' non-member construction Award.

Somervell and Johnson

Win Moles' Awards For Construction Achievement

ARTHUR A. JOHNSON, president, Arthur A. Johnson Corp., New York contractor, winner of Moles' member Award.

FOR "OUTSTANDING CONTRIBUTIONS to construction progress," Lieutenant General Brehon B. Somervell, Chief of the Army Service Forces, and Arthur A. Johnson, New York contractor, received the 1944 Achievement Awards of The Moles, New York organization of tunnel and heavy construction men. Presentation of the awards, which go annually to a non-member and to a member of The Moles, was made at a dinner at the Hotel Roosevelt Feb. 2. Selection of award recipients was made by a committee headed by Charles B. Spencer, vice president of Spencer, White & Prentis, Inc., who acted as toastmaster.

General Somervell

Given the award in recognition of his brilliant administration of the A.S.F., General Somervell has directed a larger program of construction and production than any man in history within a similar period. Organized to do nearly everything except the actual fighting, his branch of the Army builds airfields, training centers, housing for troops, hospitals, industrial plants of all types, roads, bridges, and the scores of other structures needed to service the fighting forces. The A.S.F. also provides weapons, operates lines of communication, and transports troops and supplies here and overseas.

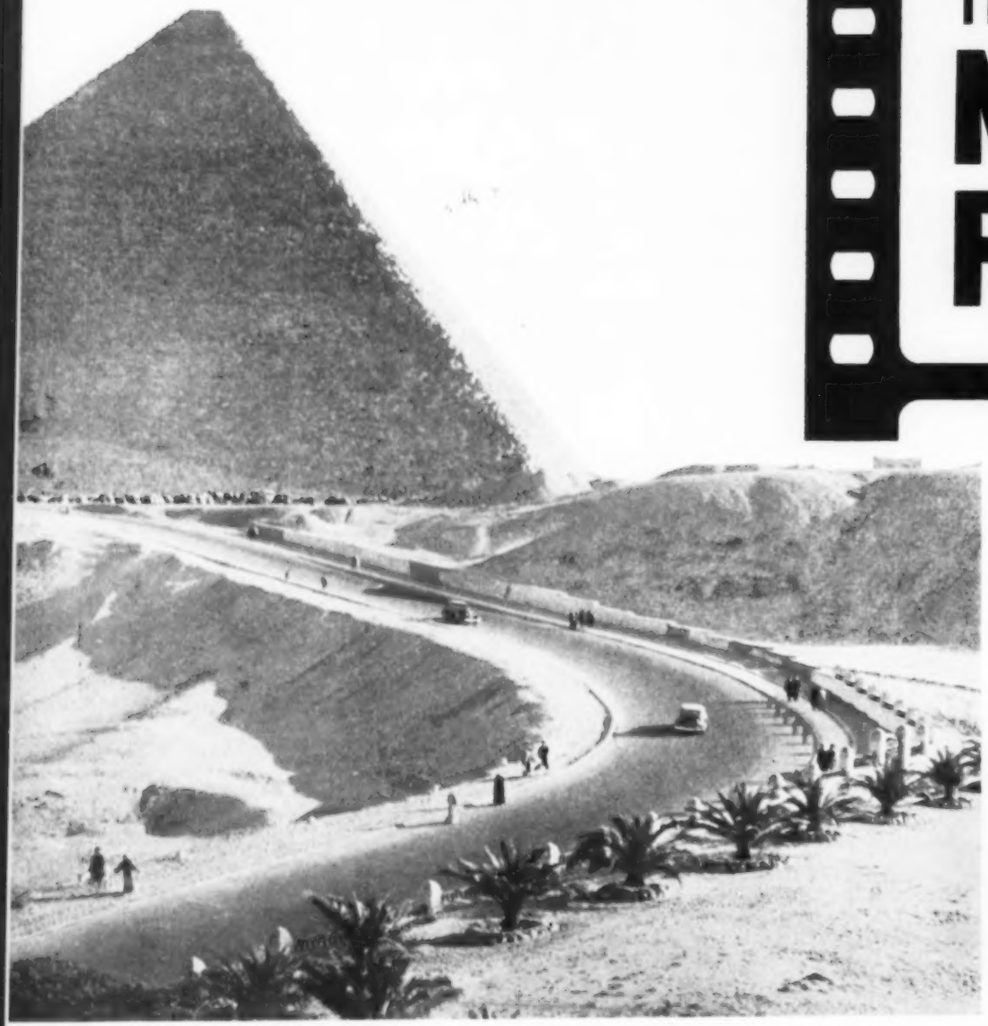
Before General Somervell's appointment in 1942 as commanding general of the Services of Supply, which was to become the A.S.F., he had for two years directed the Construction Division of the Quartermaster Corps. Before that he spent four years as WPA administrator for New York. His career with the Corps of Engineers, U.S. Army, began with his graduation from West Point in 1914. He served in various capacities with the A.E.F. in France during the first World War and has been awarded both the Distinguished Service Cross and the Distinguished Service Medal.

Arthur A. Johnson

Arthur A. Johnson is president of the Arthur A. Johnson Corp., of Long Island City, N. Y., chairman of the Post-War Public Works Committee of the General Contractors Association of New York, and vice president of The Moles. For more than 35 years, he has been engaged in building subways, tunnels and other important engineering works in and around New York. His recently completed war contracts include the Letterkenny Arsenal at Chambersburg, Pa., which was finished in 200 days at a cost of $9,000,000. He was also one of three contractors on the $30,000,000 Bermuda Army Air Base.

Among Mr. Johnson's pre-war jobs was the preparation of the site for the New York World's Fair, which was completed in eight months and involved the movement of 7,000,000 cu. yd. of earth, one of the fastest earthmoving jobs in the United States up to that time. He executed a large number of subway and tunnel contracts, including the East River tunnels of the Pennsylvania Railroad, designed a unique method for moving back the boardwalk at Coney Island, and developed Fort Tryon Park in New York. He was twice elected president of the General Contractors Association of New York and is now serving his fifth term as president of the Chamber of Commerce of the Borough of Queens.

THIS MONTH'S NEWS REEL



IN SHADOW OF PYRAMIDS of Gizeh, automobiles roll over modern highway. Mena House Gardens in foreground add to contrast between Egypt's ancient and modern civilizations.

Acme Photo

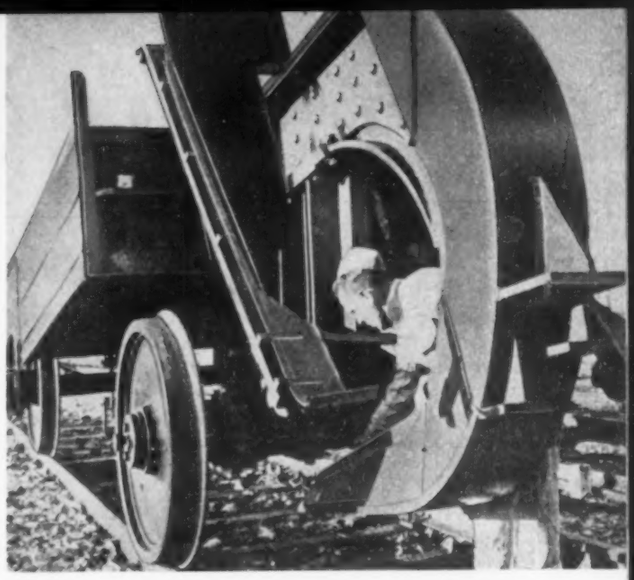
NEW-TYPE HIGH-SPEED TRACTOR, operating on crawler treads, provides motive power for hauling heavy artillery, gun crew and ammunition to firing position. Manufactured by Allis-Chalmers, 18-ton unit, which has already seen front-line action, is augmenting trucks, half-tracks, regular crawler

Page 52

FIRST SELF-PROPELLED CONCRETE SHIP (below), built for current war service, sails on maiden voyage. It was constructed in basins of Tampa, Fla., yard of McCloskey & Co. for U. S. Maritime Commission and turned over to Lykes Bros. Steamship Co. for operation. Twenty-three similar ships are included in McCloskey contract. They are 366 ft. long overall, 54 ft. beam, 35 ft. deep, and have draft of 26 ft. at displacement of 10,920 long tons, of which 4,400 tons is useful load-carrying capacity. Hull thickness is 6½ in. McCloskey's project manager on job is Neal A. Melick.

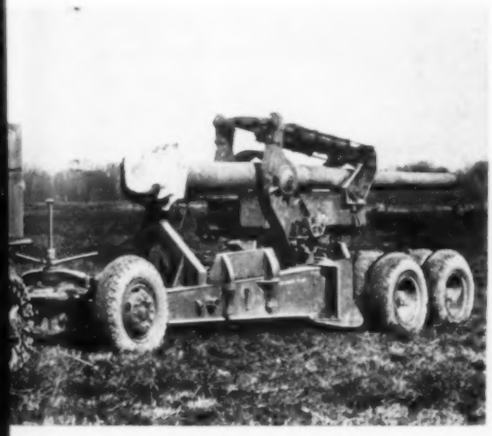
MANHATTAN BRIDGE (below) is name given by Yanks to ponton bridge built by Army Engineers over Volturno River in Italy. Trucks and jeeps speed over it to road on other side that leads to original stone bridge, at left, which was demolished by Nazis in their retreat.

Acme Photo

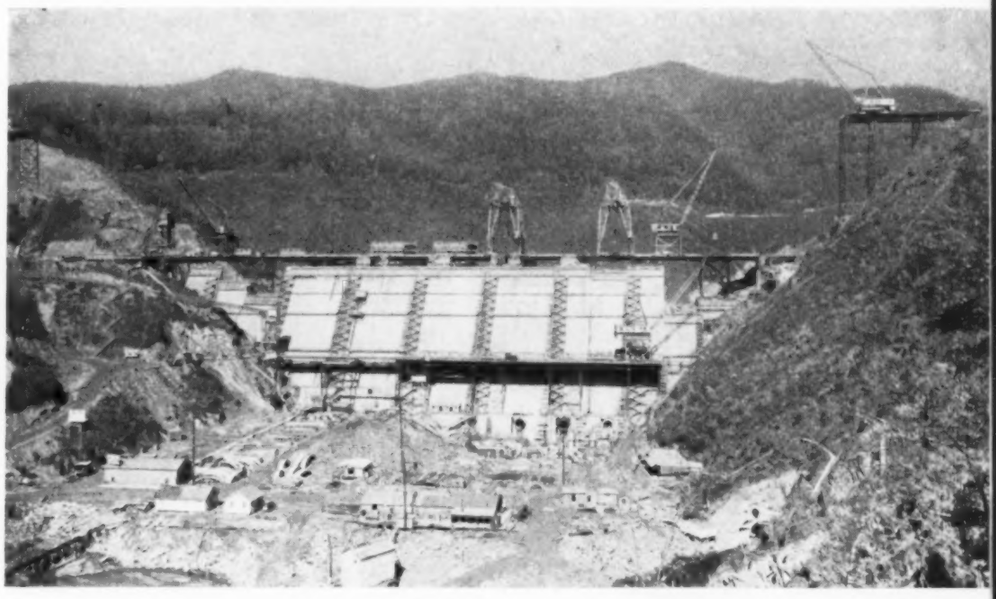


RAILWAY TRACKS IN ITALY (left) are destroyed by retreating Germans. Special 10-ton Nazi wrecking machine (right) captured by Allied Commandos in Termoli, has large hook at rear which, on being hauled along lines, rides under wood ties and rips them up. At same time 2-lb. explosive charge, with delayed fuses, are dropped on rails which are shattered some seconds later.

British Combine Photo

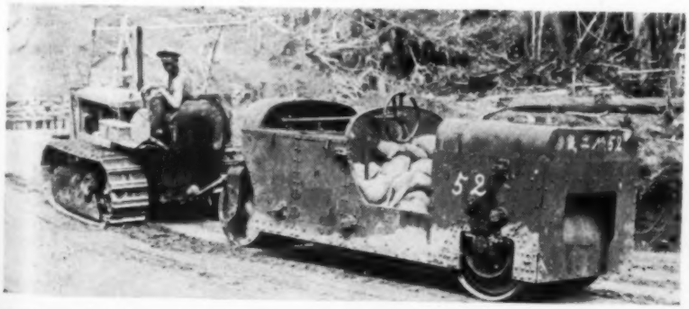


tractors and other units in moving guns over rough ground and through deep mud, loose sand, woods and jungles. Mechanical details of new tractor, at present a military secret, may find application to commercial products after war, according to spokesman for manufacturer.



TVA'S FONTANA DAM grows at rate of 200,000 cu. yd. per month, with concreting now about half completed. Here dam has reached second of three construction trestles from which nearly 3,000,000 cu. yd. of concrete will be placed by end of 1944. Dam, on Little Tennessee River in western North Carolina, will be 460 ft. high and will store 4,570,000 acre ft. of water.

Bureau of Reclamation Photo



JAPANESE ROAD ROLLER is used by American soldiers to build highway between Dobadura and Ora Bay in New Guinea. Captured by U. S.—Australian forces, machine was piled full of sandbags and coupled to Caterpillar diesel D_2 tractor.

Acme Photo

WATER STORAGE AT SHASTA DAM (right), U. S. Bureau of Reclamation structure nearing completion on Sacramento River in California by Pacific Constructors, Inc., begins Jan. 1. Completed dam, 602 ft. high, will contain 6,100,000 cu. yd. of concrete. When released, water will supply needs of California's Sacramento Valley for irrigation, navigation, domestic and industrial uses, and generation of hydroelectric power and energy.

AIRDROMES AROUND THE

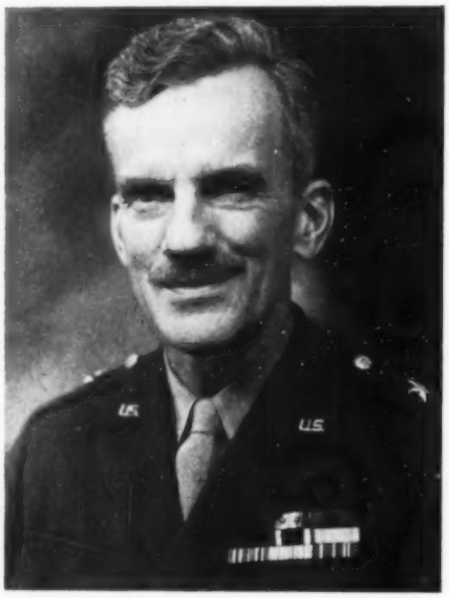
How Road-Building Methods and "Bantam" Equipment Have Been Adapted by Airborne Aviation Engineers to Provide Air Bases in Theaters of War

By Brigadier General STUART C. GODFREY, U. S. Army
Air Engineer, Army Air Forces

AIR BASES WANTED—wanted in a hurry—to serve the rapidly growing strength of the Army Air Forces! Bases in every overseas theater—before our heavy bombers can deliver their punch. Bases that can sometimes be wrested from the enemy, as this war in places develops mainly into a struggle for air bases. Bases that may have to be built from scratch on a barren island.

In this war, the construction of airdromes has been everywhere one of the most challenging tasks of the military engineer. Here at home, an impressive network of fine airfields and depots is approaching completion. The field airdrome overseas, however, is generally a less elaborate structure. It varies greatly in characteristics as in location. You may find a landing strip hugging a beach, perched on an open plateau, or carved out of a jungle. It may be little more initially than one graded earth runway, with provision for dispersing planes and servicing them with gas and bombs. But, such a primitive field—which may be put into service with a very few days' work—is likely to develop progressively into a more and more complete airdrome, with gasoline and bomb storage, housing for the troops, and so on.

War puts a premium on speed in all things. To achieve speed in construction, every time-saving device and technique is needed. One such device is the steel landing mat, developed by the Corps of Engineers, which has been used so successfully overseas. The steel mat is not a magic carpet and cannot be floated on a swamp. It is heavy and its transportation



BRIG. GEN. STUART C. GODFREY, Air Engineer, Army Air Forces. U. S. Army Air Forces Photo

• In the accompanying article, prepared especially for CONSTRUCTION METHODS, General Godfrey, who recently made a 45,000-mile circuit of the globe, presents a graphic picture of airdrome construction for our armed forces overseas. Much of this work has been done by our newly organized Aviation Engineer units, using "bantam" equipment of types common in road-building practice and flown by plane to sites inaccessible by other means of transport.

General Godfrey says, significantly: "The bulldozer must accompany—or even precede—the airplane into every new theater of war."

BANTAM EQUIPMENT (below), which makes possible operations of airborne Aviation Engineers, is being loaded into a transport plane during Tunisian operations. This is a midget bulldozer, specially developed for airborne needs.

E WORLD...

constitutes a problem. Yet in many situations it has made possible a hard-surfaced runway in a matter of a few days, and when placed on a suitable foundation it will afford continuing service for the heaviest planes. Most generally suitable has been the "pierced plank" type.

Another time-saving technique is afforded by the airborne Aviation Engineer battalion. This unit is designed to be transported in cargo planes or gliders. Thus it can reach a site inaccessible or slow of access by land or sea, such as a captured airdrome behind enemy lines or an isolated spot in the jungle. The development work to find suitable light equipment for this unit was pushed in the summer of 1942 with the able help of the Engineer Board. The activities of the first unit were speeded up that fall to permit the use of a small component of airborne engineers as a trial shot in the North African campaign. This required some good teamwork on the part of all concerned, particularly the equipment manufacturers who cooperated enthusiastically. Transporting a bulldozer by plane was something new under the sun.

Impressions of 45,000-Mile Trip

Not long ago I completed a 45,000 mi. circuit of the globe that gave me a remarkable opportunity to see many of these airdromes, at least a hundred of them, and the work of scores of Aviation Engineer battalions. These Aviation Engineers are a part of the Army Air Forces, specially organized and trained for airdrome construction. But many other troops also build airdromes—Army Combat Engineers and General Service Regiments, Naval Construction Battalions ("Seabees") and the troops of our British Allies, the Royal Engineers. Builders, too, in India, China and elsewhere are many thousands of native laborers. They do not work with the same urgency as Americans, and they have little except hand tools, but they get a surprising amount done.

A few impressions of this trip—difficult to summarize—are given mainly by the photographs herewith, with their titles and comments.

England

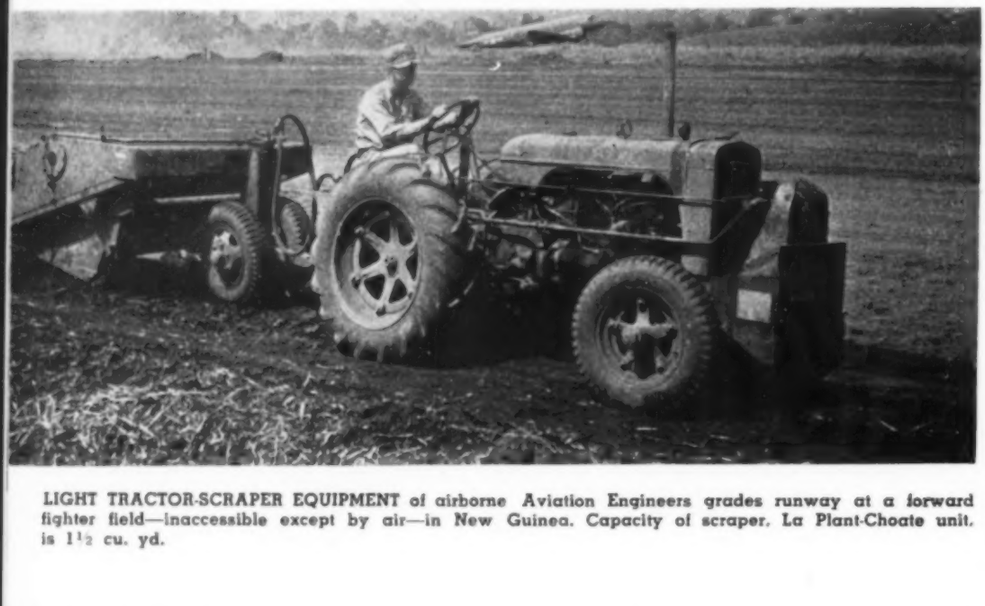
England is now essentially one vast airdrome. The British deserve much credit for their early appreciation of the need of dispersed airdromes. The defect of Hitler's attempt to overwhelm England by air invasion was due, first, to the superiority of the British fighter plane; second, to the fact that the British had

BOMBING OF AIRFIELD (below) interrupts earth-moving operations by La Plant-Choate tractor-hauled scraper and bulldozer, as operators seek cover.

STEEL LANDING MAT (below) of "pierced-plank" type is being laid somewhere in Alaska by Army Engineers.

BEING LOADED INTO PLANE for transport by air to site of airfield construction is this bantam-size Adams leaning-wheel grader.

RUBBER-TIRED TRACTOR is loaded for air transport.



LIGHT TRACTOR-SCRAPER EQUIPMENT of airborne Aviation Engineers grades runway at a forward fighter field—inaccessible except by air—in New Guinea. Capacity of scraper, La Plant-Choate unit, is 1½ cu. yd.

WITHIN BODY OF PLANE (below) small-size Adams leaning-wheel grader is en route to its destination by air.

provided a wealth of well-dispersed and inconspicuous airdromes from which to operate.

Still more airdromes are being built in England, many of them by our Aviation Engineer troops. These airdromes resemble our permanent airfields at home, with concrete runways and taxiways, housing in the form of Nissen huts with bricked-up ends, steel framed hangars, and underground storage tanks for gasoline.

Africa, Sicily and Italy

When I had visited this theater, during the rainy season, the Aviation Engineers were engaged in a battle with MUD. Few airfields existed to start with, and those near the ports of Oran and Algiers were low, flat, and deluged with almost daily rains. Add to that, our Engineers were delayed in getting much of their equipment. At first the going was tough!

But as the rains stopped in the spring, and our Air Force grew in numbers, these same Engineers built airdromes, almost overnight, for the successful advance on Tunisia. By July more than one hundred fields had been put into operation. Some of these required only a simple grading and compaction job, which could be done in three days' time. Others, like the airdrome at Bone, involved laying over silt a blanket of 65,000 cu. yd. of sand, covered with a 6,000-ft. steel runway. Two weeks was excellent time for this project.

Aviation Engineers build, maintain, and help to defend field airdromes. Like other engineers, they are combat-armed and trained, and their anti-aircraft machine guns brought down more than one Axis plane over these fields. Moreover, they are skilled at removing mines and booby traps. One field which I visited had required the removal of more than 1,700 mines from one runway after its capture.

One day in July, when the Sicilian operation was fairly under way, I visited several airdromes on that island. Avia-

UNLOADING EQUIPMENT from airplane at forward field is done with aid of native labor. This is part of a 2½-ton truck brought up in pieces.

EARTH FILL is dumped from tilting bucket mounted on rear of jeep.

tion. Engineers had moved in early and had already taken over and put into operation eight airdromes as advanced fighter fields. One of these had been carefully prepared for demolition, but the Italians had failed to explode the charges. They did, however, return and shower this field with delayed action bombs, which had a considerable nuisance value and caused some casualties.

Later, during the landing at Salerno, Aviation Engineers were again early ashore, and by the third day had succeeded in building a fighter field near the beach. This was very dusty, to be sure, and could be kept in operation only by frequent wetting, but it made possible invaluable close fighter support for the hard pressed ground troops. Italian airdromes are mainly provided with graded earth runways, which require lengthening and hard surfacing for our bigger and faster planes.

In all of these operations Aviation Engineers have constituted a part of General Spaatz's Air Force, and have operated under Air Force control. Hansan Baldwin, writing of the air operations in Sicily, referred to the Aviation Engineers as an "essential part of the air combat team."

India

In the past, construction of airdromes in India has been a slow and tedious process. Rock is brought in by train on overcrowded railroads. Native contractors, employed by the British, recruit thousands of native laborers, men and women, many of whom have been taken from the tea plantations. Concrete is mixed by hand and carried in trays. Long lines of women form, tray on head, and make leisurely progress in passing on the tray to the woman at the end of the line, who dumps it into the forms.

Now, however, western methods are speeding up this slow tempo. American Engineer troops, with our unrivalled

TAKING OFF from an Army Air Base in the South Pacific is famous Boeing B-17 Flying Fortress. This runway is of steel mat overlying coral.

NORTH AFRICAN AIRDROME is shown in initial construction stage, with patrol graders making first run over plowed field. This field will be ready for operation in three days.

CHINESE GANGS (below), lacking mechanical equipment, haul roller by hand to compact airfield surface.

MIDGET TAMPING ROLLER is hauled by small-size tractor-bulldozer.

SLOW TEMPO of airdrome construction in India is speeded up by use of steel landing mats at some airdromes.

PINNACLES OF EARTH are left standing as yardsticks to measure excavation made by Chinese contractor.

HANGAR OF CANVAS AND STEEL is erected at site in Southwest Pacific.

equipment, are on the ground. Construction of some fields is being expedited by the use of steel landing mats. Aviation Engineers have also helped in the task, as recently announced, of building a new road into Burma.

China

Difficulties of supply limit the employment of our Engineer troops in China. The Chinese themselves, however, are capable airdrome builders. Runways of stone, 2 ft. and more in thickness, are constructed by thousands of Chinese laborers, men and women. Everything is done by hand; the rock is quarried, crushed, and transported in baskets to the site. It is then laid by hand in graded layers and rolled by huge stone rollers pulled by a hundred laborers. This rock bed is bound by pouring in a paste of mud. The absence of asphalt locally results in a relatively inferior surfacing job. Chinese laborers are extremely cheerful in their work, and their great numbers offset lack of equipment and enable good progress to be made.

New Guinea

The Engineers in General MacArthur's theater, after their initial work in Australia, moved into New Guinea. Here they started from scratch, and had to build docks and access roads, as well as a network of dispersed airdromes. The results are impressive. The landing fields

(Continued on page 120)

CHINESE CONSTRUCT (below) these stone runways. Natives make up in numbers what they lack in equipment.

THATCHED CONSTRUCTION of native type (below) has saved money and troop labor in the South Pacific.

NARROW PAVEMENTS WIDENED WITH *Stabilized Shoulders*

By H. C. JAHNKE
District Maintenance Engineer
Minnesota State Highway Department

EARTH TRENCH for stabilized shoulder along pavement is excavated to 3-ft. width and 4-in. depth by motor grader equipped with special 3-ft. blade.

CLAY-GRAVEL STABILIZATION PLANT of Ashworth-Hawkinson Co., contractors, includes power shovel, in background, crusher, mixer and loading equipment powered by International diesel engine.

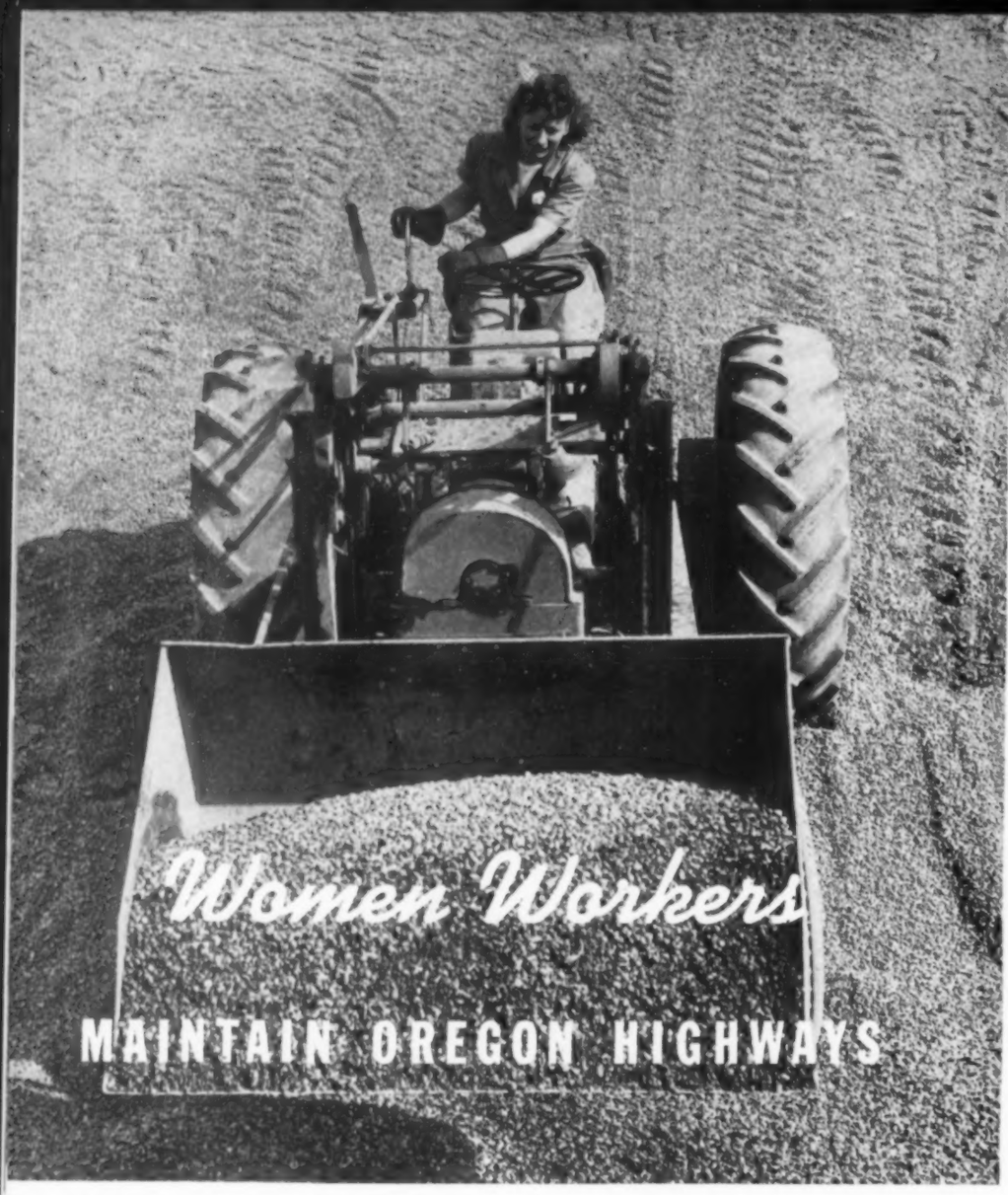
SHOULDER STABILIZATION and adequate maintenance by the Minnesota State Highway Department is serving to relieve the problem of a mounting accident toll resulting from heavier transport traffic on a considerable mileage of 18-ft. concrete pavement. The ordinary earth shoulders would not bear up under the constant turning out of the heavier vehicles on the rather narrow pavements in recent years. Edge rutting, rapid loss of earth material and dangerously low spots developed. Filling low areas with selected natural soils was more or less of a failure, because of their comparatively unstable nature during both wet and dry periods.

Under the direction of C. L. Motl, state maintenance engineer, and J. C. Robbers, his assistant, a program of construction of stabilized clay-gravel shoulders was

(Continued on page 148)

STABILIZED MIX is applied in two successive 2-in. courses to road shoulder from spreader box.

MULTI-TIRED ROLLER compacts clay-gravel shoulder which is then treated with calcium chloride to prevent loss of fine binder soil.



MATERIAL HANDLING also employs some women workers, most of whom are engaged in distributing crushed stone or gravel. Here KAY BIEHLER operates tractor-loader.

MAINTENANCE CREWS on the Oregon highway system during 1943 included 75 women employees. This situation came about primarily because labor is a bottleneck on Oregon highway work but also because of previous success in employing women on work of this sort (*Construction Methods*, November, 1942, p. 63). During the 1943 season women served in almost all capacities, as will be seen from the accompanying list, not even excepting night watchmen and such positions as leverman on a road-oiling crew. This last job, in which the operator rides a footboard just above jets discharging steaming hot oil, is particularly "messy" and might be considered one of the last places on which a woman worker would be willing to serve.

As in the previous report, this year's record of women's service is again good and Oregon highway officials heartily favor continuing the employment of women maintenance workers. It is notable that the women have done better and are employed more extensively on maintenance than on engineering and new construction. In the latter activity, women are employed chiefly in the rock surfacing operations (twelve women) and in weighing or record keeping (six women).

On the survey crews and the engineering staff generally, although a dozen or more women have been on outdoor crews, their work has been chiefly record keeping, weighing trucks, etc. A number who tried out as chainmen on survey crews quit these jobs because of susceptibility to poison oak. On maintenance surveys there is less of the poison oak objection.

Highway maintenance forces in Oregon have been depleted about 20 percent as the result of transfer of male personnel to the armed services. About 400 out of 2,000 employees are now in government service. However, by increasing the number of hours worked per week and eliminating non-essentials, such as landscaping and weed cutting, it has been possible to keep the highway surfaces maintained

(Continued on page 150)

HOT MIX (below) will be carried from plant to repair crews in truck driven by FRIEDA KNORR.

STOCK PILING of crushed stone (below) is done by tractor-loader, with KAY BIEHLER in operator's seat.

STOP AND LOOK is probable motorist reaction to signal of feminine flagman.

WOMAN DRIVER, BERNICE CARTER, comes into her own in Oregon, where she handles 2- and 3-ton trucks with skill and ease.

OREGON STATE HIGHWAY DEPARTMENT'S WOMEN ON MAINTENANCE IN 1943

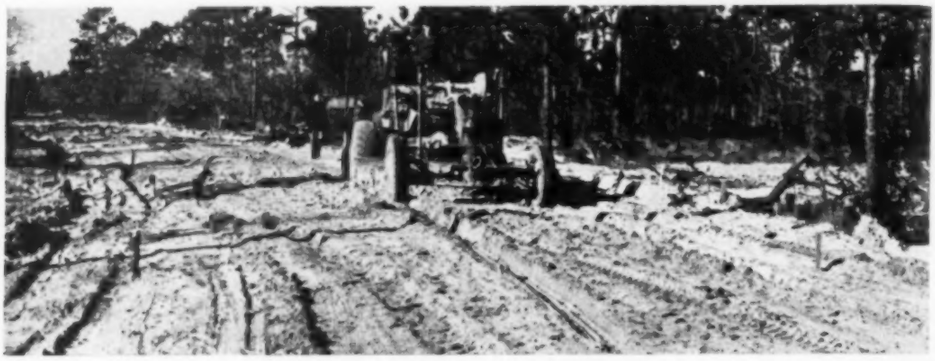
Truck drivers	30
Flagmen	18
Timekeepers	11
Laborers	8
Night watchmen	3
Pit men (for cleanup around power shovels)	2
Oiler leverman	1
Spotting foreman	1
Chainman	1
TOTAL	75

MAINTENANCE SURVEY CREWS employ several women like **FRIEDA HONIXFELD,** below, seated on back of truck among survey equipment. At right she takes tape measurement with aid of plumb bob line.

RECORD KEEPING (below) is one of jobs in which **EVELYN MONTGOMERY,** one of Oregon's women maintenance workers is successfully replacing men.

U. S. Marines Build *Soil-Cement Roads* In Training Course

U.S. MARINE CORPS ENGINEERS at New River, N.C., learn step-by-step construction procedure as part of the Engineer Equipment Course which is attached to the Engineer Battalion commanded by Lieut. Col. Nelson K. Brown. One of the projects completed in this training course, under the direction of Capt. Theodore Drummond, was the construction of a soil-cement roadway. Methods and machines used are shown in the accompanying Marine Corps photographs.



1 EXISTING SOIL is shaped up by self-powered blade grader to receive cement.

2 MARINE ENGINEERS distribute cement in paper containers along roadway.

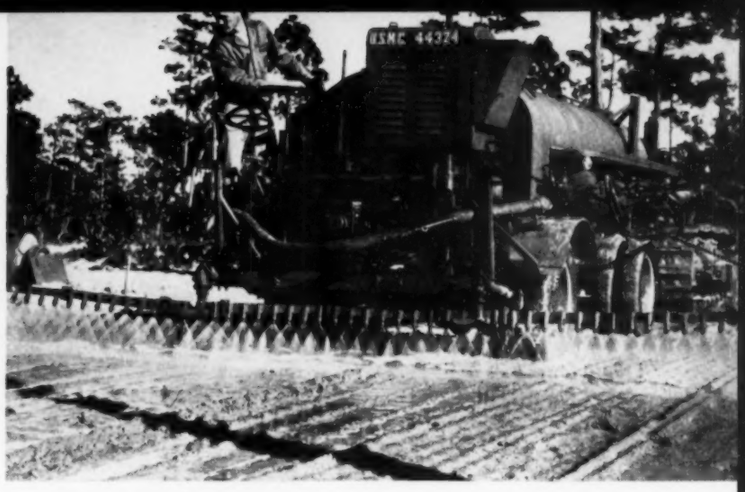
3 HAND RAKES (right) and push brooms are used to spread cement uniformly over soil.

4 SOIL AND CEMENT are mixed by gang-plow drawn by tractor.

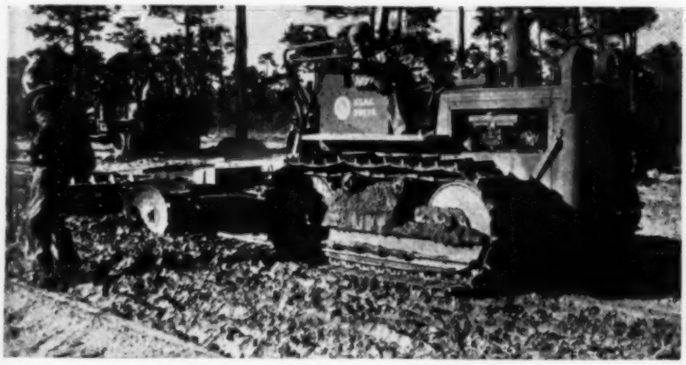
5 DISK HARROW (below) pulled by tractor mixes soil and dry cement.

6 THOROUGH MIXING of soil and cement (below) is provided by tractor-hauled Seaman Pulvi-Mixer.

7 UNIFORM FURROWS are made in material to prepare it for watering.



8 WATER IS SPRAYED on dry soil-cement mix by tank truck.



9 AFTER SPRAYING, wet materials are mixed with disk harrow hauled by International tractor.

10 PULVI-MIXER, following tank-truck, mixes soil and cement which has been saturated with water.

11 MIXED MATERIAL (left) is shaped up by motor grader as road nears completion.

12 ROLLER PULLS scratch drag (right) over roadway surface.

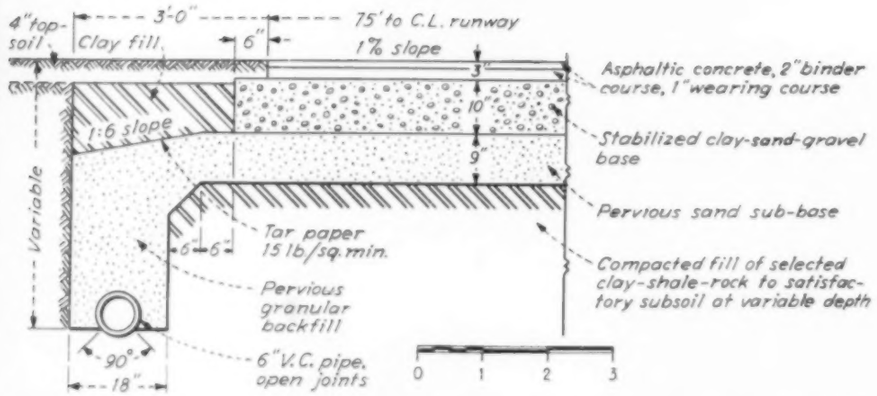
13 SOIL-CEMENT ROAD (below) is completed and ready for use.

Well-Built Base Supports

Asphalt Runways

At Kentucky Airport

ON A 760-ACRE HILLTOP SITE 10 mi. west of the city and 440 ft. above the Ohio River, the Civil Aeronautics Administration and the Frank Mashuda Co., general contractor, Milwaukee, Wis., are building for Covington, Ky., a Class 4 airport with four 5,500x150-ft. asphalt-paved runways. Designed by the Third Region of the CAA, Chicago, for 37,500-lb. wheel loads (75,000-lb. plane loads), the pavement consists of 3 in. of hot-mixed, hot-laid asphaltic concrete on a substantial foundation which is carefully constructed to assure adequate bearing capacity and freedom from future trouble with water absorption or volume change. Under the asphaltic concrete surface is a 10-in. stabilized clay-sand-gravel base



DEPENDABLE FOUNDATION of selected compacted material supports 9-in. granular blanket and 10-in. stabilized base under 3-in. asphaltic concrete pavement for airport runways. Sand sub-base on 1 percent slope drains into edge trench backfilled with granular material.

AIRPORT CONSTRUCTION is managed and directed at site for Civil Aeronautics Administration by **T. E. STEPHENSON** (left), associate airways engineer in charge of job, here talking to **A. E. DELO**, superintendent, Frank Mashuda Co., general contractor.

2½-YD. SHOVEL digs laminated limestone-shale formation and loads material into bottom-dump diesel hauling unit for disposal in runway embankment.

BROAD SHOULDERS 175 ft. wide bordering paved runways are built up of rejected plastic clays and other materials (not acceptable for use in embankment under pavement) which can be com-

resting on a pervious sand sub-base 9 in. thick.

Foundation preparation goes even deeper than these two courses, which provide for load distribution and subsoil drainage. Runway embankments, for example, are constructed of a selected clay shale or combination of clay shale and limestone which can be compacted to required density. In cut areas, all undesirable materials which have an affinity for water or contain excessive moisture are removed below grade until a soil of satisfactory character is reached, and the excavated material is replaced with compacted clay-shale-limestone fill. Where runway subgrade strikes satisfactory clay shale material in cuts, the shale is scarified and compacted to 6-in. depth before the pervious sand course of the runway foundation is placed. When the subgrade runs into rock, the rock is excavated to 12 in. below grade and is replaced with a compacted fill of selected clay-shale-limestone.

Contract Quantities—Construction of the airport under the Mashuda contract

BACKING OVER COMPACTED SUBGRADE, trucks dump loads of sand to be spread in one course by small tractor-bulldozers to full depth of 9-in. granular blanket. Hose spray from tank truck applies water during compaction of sand course. In background on this taxiway, another truck is backing in from opposite direction over first 4-in. layer of stabilized clay-sand-gravel base to dump additional processed material for spreading by adjacent bulldozer.

CLAY SHALE-LIMESTONE MATERIAL deposited by hauling units in paved runway area is struck off by bulldozer to 8-in. loose depth for compaction.

PRIME COAT of 0.25 gal. of MC-1 cut-back asphalt is applied by pressure distributor to base which has been thoroughly brushed with power broom. If war had not eliminated MC-0, latter grade would be preferred to penetrate compacted, stabilized soil.

pacted by sheepsfoot rollers to 93 percent density. Note that this shoulder fill is being raised to considerably higher grade than that of runway subgrade at left.

CONTINUOUS PUGMILL of stabilizing plant mixes clay-sand-gravel for pavement base. Crane with 1-yd. clamshell charges binder soil out of small stockpile into hopper above clay shredder. Sand-gravel material is loaded by same crane out of large stockpile at right into second hopper of plant. Belt conveyor delivers processed mixture to truck-loading bin. Two stabilizing plants are employed.

SELF-PROPELLED PAVING MACHINE pushes truck ahead as latter dumps hot asphaltic concrete into hopper to be spread and struck off for 1-in. wearing course on top of 2-in. binder course. Front drive wheels straddling truck travel on binder, while rear roller drive wheels run on top of hot mix struck off for 1-in. surface course.

ASPHALTIC CONCRETE is produced and placed in runway pavement by Payne & Dolan, subcontractors, under supervision of ERVE W. HABECK, superintendent, who stands here beside shed housing two diesel-electric generator sets which supply power for asphalt mixing plant.

STUDY IN TEXTURES is aided by pocket rule laid on binder and pocket pencil placed on wearing course. Binder contains 1-in. maximum size aggregate and 4.7 percent asphalt; top course is made with ½-in. maximum size aggregate and 6.8 percent asphalt.

ASPHALT MIXING PLANT capable of turning out 5,000-lb. batches of asphaltic concrete at rate of 90 tons per hr. is operated by electric motors of about 225 total horsepower for which power is supplied by two diesel-electric generator sets in open-end shed in front of dryer. Steam for plant is furnished by 90-hp. boiler.

requires more tan 3,000,000 cu. yd. of excavation, 84,000 lin. ft. of drainage lines, 185,000 tons of pervious sand subbase, 242,000 tons of stabilized gravel base and 446,600 sq. yd. (70,500 tons) of asphaltic concrete pavement. To handle this volume of work within a stipulated completion period of 175 calendar days the general contractor and a group of associated subcontractors assembled on the job a mass of construction equipment listed in an accompanying tabulation. About 60 days' work remains to be completed in 1944.

Airport Grading

As first estimated, cuts and fills in the airport area were figured to balance on a basis of 25 percent shrinkage. Actual shrinkage is somewhat less than this estimate, and excess material is disposed of by extending fills on the site. The total excavation quantity of more than 3,000,000 cu. yd. includes about 150,000 cu. yd. of undercut below runway subgrade for removal of undesirable materials. Maximum cuts are 20 to 28 ft. deep, and the highest fill is 20 ft.

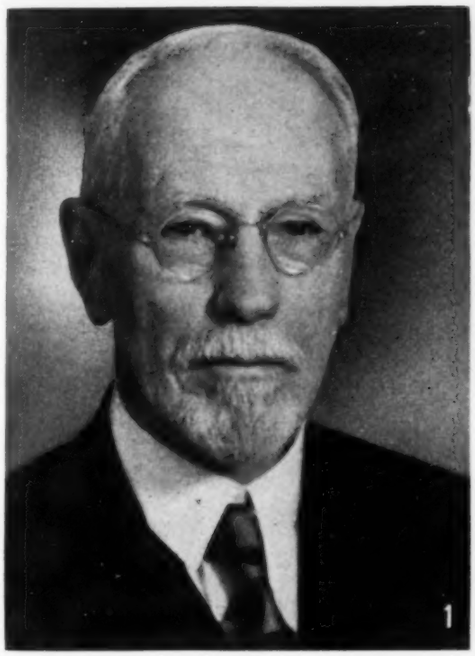
Soil stratification, the result of alluvial deposits, was found to be fairly uniform over the entire area. Under 6 to 8 in. of topsoil, the strata consist of the following, in order: 2 to 2½ ft. of silt and silty clay with a high affinity for water, about 3 ft. of sand clay and about 2½ ft. of plastic clay, containing 26 to 28 percent moisture, which cannot be compacted for use under pavement. Beneath these strata, about 8 ft. below the surface, occur interbedded stratifications of limestone and shale extending to solid limestone rock at variable depths. In cuts, the excavators struck rock at depths of 14 to 20 ft. For the entire job, the quantity of limestone rock requiring drilling and blasting is estimated to be about 75,000 cu. yd.

To move material at the rate required to keep grading ahead of drainage installations and runway construction, the contractor placed on the job 20 scraper outfits of 12-yd. to 30-yd. size and two diesel shovels, a 2½-yd. and a 2¼-yd., served by a fleet of ten hauling units comprising seven 13-yd. (water-level) bottom-dump wagons and three 10-yd. end-dump trucks. Of the 20 scraper outfits (13 are drawn by crawler tractors, and seven (12-yd. size) by two-wheel pneumatic-tired tractors.

Hauls are comparatively short, the average one-way distance being about 2,000 ft. for the pneumatic-tired wagon and truck units and less than 1,200 ft. for the scraper outfits. Where possible, the pneumatic-tired tractor units are used on the longer scraper hauls. The two diesel shovels take care of the harder digging in laminated shale-limestone and in blasted limestone rock. A 1¾-yd. crane is employed for other purposes than straight earth excavation. Working a 10½-hr. day shift and a 10-hr. night

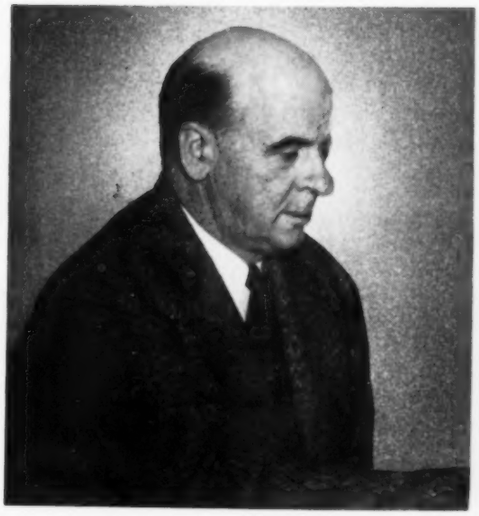
(Continued on page 86)

Present and Accounted For... A PAGE OF PERSONALITIES



HONORARY MEMBERSHIP

HONORARY MEMBERSHIP in American Society of Civil Engineers has been conferred on: (1) EDWARD H. CONNOR, vice president and consulting engineer, Missouri Valley Bridge & Iron Co., Leavenworth, Kan.; (2) GERARD H. MATTHES, engineer, Office of President, Mississippi River Commission, Vicksburg, Miss.; (3) THOMAS H. MacDONALD, commissioner, Public Roads Administration, Washington, D. C.; Portrait of a fourth recipient of honorary membership in society, FRANCIS T. CROWE, general superintendent for Pacific Constructors, Inc., on Shasta Dam in California, was published in *Construction Methods* for January, 1944.



NEW PRESIDENT of Western Association of State Engineers is L. C. BISHOP, state engineer of Wyoming for last five years. He is in charge of state's water administration, president of Board of Control, secretary of Board of Examining Engineers, and member of Governor's statewide planning committee.

ELECTED PRESIDENT of American Association of State Highway Officials at recent annual convention is S. C. HADDEN, chairman of Indiana Highway Commission. Mr. Hadden is a nominee for director on the 1944 slate of officers and directors of the American Road Builders' Association.

TAKING OFFICE for second time as president of American Road Builders' Association is CARL W. BROWN, chief engineer of Missouri State Highway Department for last seven years.

INSTALLED AS PRESIDENT of Associated General Contractors of America at annual meeting in Chicago this month is WILLIAM MUIRHEAD (left), president of William Muirhead Construction Co., Durham, N. C. HARRY A. DICK (right), president of Gilpin Construction Co., Portland, Ore., was elected vice president.

HEADQUARTERS SHOP, with floor area of 44,800 sq. ft., is equipped to make repairs on or rebuild both light and heavy road-building machinery.

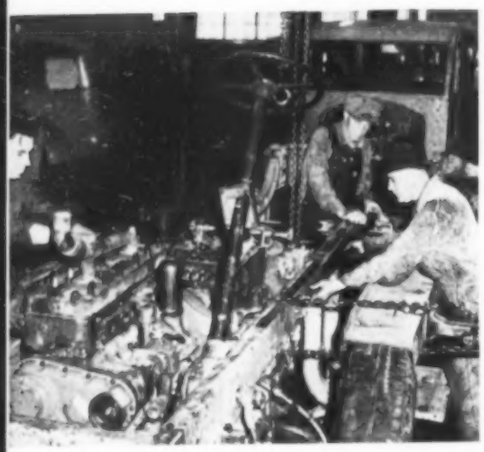
TRUCK TIRE IS INSPECTED for inside fabric breaks, using Manley air-operated tire spreader.

Repair Shops

Service California's Road Maintenance Equipment

By RUSSELL H. STALNAKER

Equipment Engineer, California Division of Highways, Sacramento, Calif.



MECHANICS CHECK TRUCK FRAME after straightening. This truck was badly wrecked and is being thoroughly reconditioned. Picture shows progress of reassembly, cab being next unit installed.

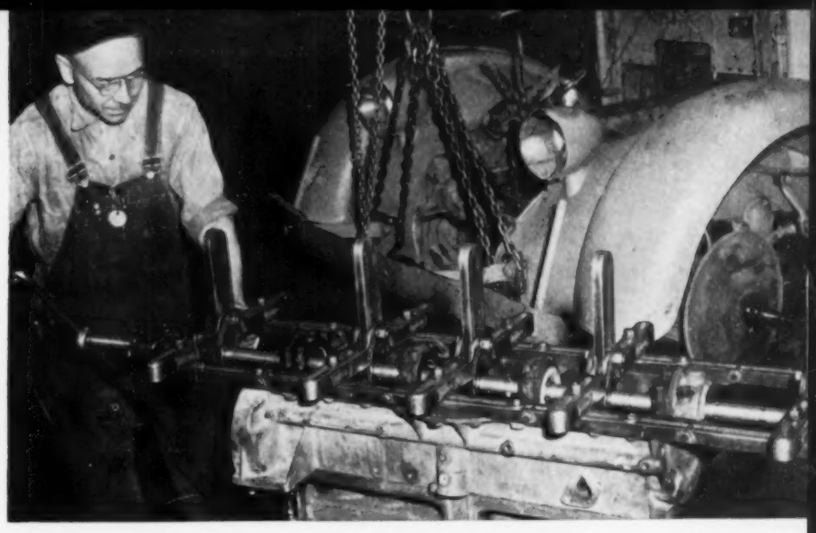
THE HEADQUARTERS SHOP of the California Division of Highways, located in Sacramento, occupies 44,800 sq. ft. of floor space and is devoted to the general upkeep and repair of equipment used in maintaining the state highways. The equipment varies considerably in size and type, from small recording devices for registering pavement roughness and distances, to the large power shovels, snow plows, graders, compressors, and trucks used in the general maintenance of highways.

This shop is separated into several departments which are equipped to do the necessary work on the type of equipment which the particular department is set up to handle. Among these is a department devoted to automobiles, where not only cars of the Division of Highways are taken care of, but those of other state departments. All classes of repair work,

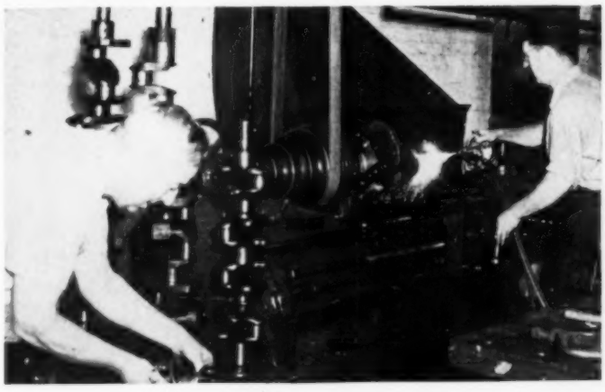
MACHINIST TRUES UP (below) and rethreads axle housing tube end after straightening.

TOOL-ROOM ATTENDANT (below) issues large twist drill by tool check, conventional method of keeping tools where they belong.

WARPED SURFACE of cylinder head is trued by machinist. Machine used is Garvin No. 15 vertical milling machine and 12-in. inserted tooth cutter.



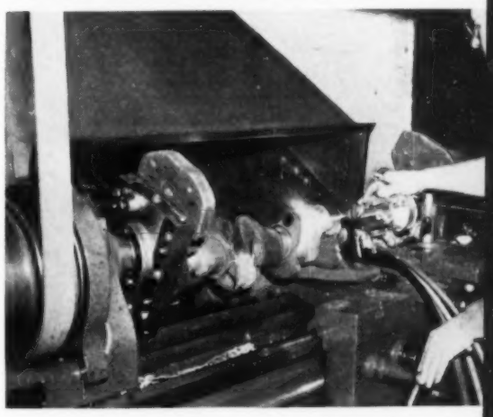
MAIN BEARINGS are line-bored to crankshaft size. Cutters in this bar can be set to bore as close as 0.0005 in. Apparatus used to do this work is Trindl line-boring bar, part of Headquarters Shop equipment.



CRANKSHAFTS are checked to determine size for building up journals with metal spray, one of later operations being done at Headquarters Shop.

RECONDITIONING TRUCK SEATS and cushions is some of important work of trimming department, but all types of trimming work are done here.

METAL-SPRAYING (below) is applied to build up crankshaft journals. After preparing journals by cutting ribs or grooves, wire metal is heated by oxyacetylene process and sprayed by Metco spray gun. Fumes from this operation are carried through discharge duct and exhausted in open air.



except extensive body repairs, can be done in this department. The number of mechanics of different trades varies somewhat seasonally, but averages about 85 men. The repairs made include all classes of automotive and heavy equipment work.

There is a complete tool and stock room organization and an accurate record and accounting is kept of all operations.

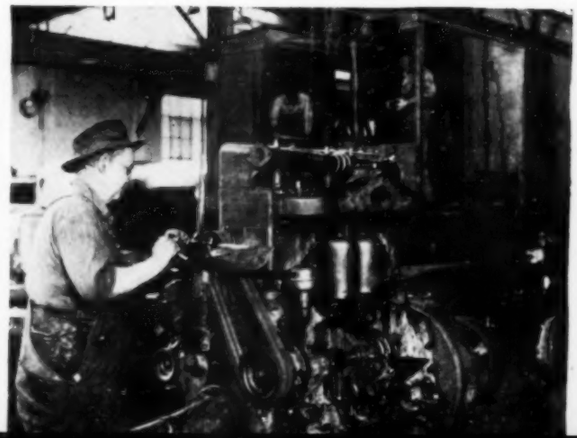
Special equipment for maintenance work which is not manufactured commercially is designed and built at this shop. In the present national emergency other equipment for which priorities could not be obtained has been built in the shop by the use of secondhand material and remodeling of existing equipment.

Ordinarily there are 150 jobs of different types going through the shop at a time, and the quantity of work handled is fairly even the year round.

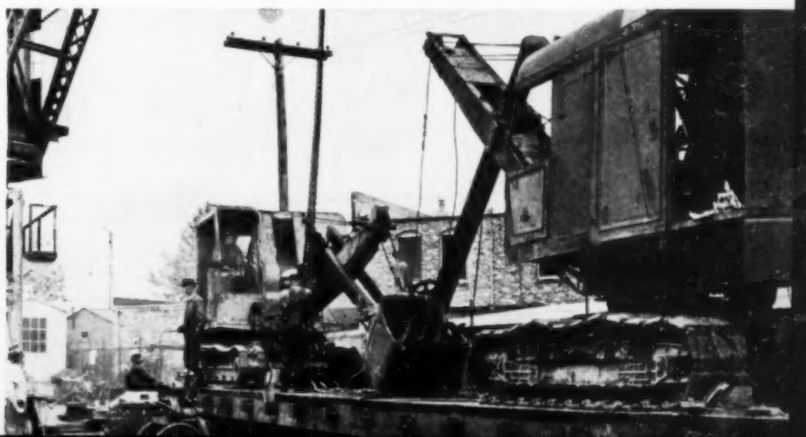
In addition to the Headquarters Shop at Sacramento, nine district shops are located at points throughout the state to handle repairs in the districts in which they are located.

The accompanying pictures illustrate various phases of the work at the Headquarters Shop, and some of the special equipment built there.

FINAL ASSEMBLY of heavy-duty oil engine (below) nears completion for use in power shovel being overhauled in background.



POWER SHOVELS (below) are delivered to Headquarters Shop by rail for general overhauling. Preparations are being made to unload.



THE JOB JESTER

CARTOONS DRAWN FOR CONSTRUCTION METHODS

"What would you suggest we do about this dangerous crossing, Mr. Smith?"

"He's right at the most dangerous age . . . stands up in his high chair and plays on the stairsteps!"

J. A. Patterson Cartoon

Construction Details on the

Inter-American Highway

By E. W. JAMES

Chief, Inter-American Regional Office,
Public Roads Administration, Federal Works Agency,
Washington, D. C.

FOREMOST AUTHORITY on Inter-American Highway is E. W. JAMES, chief, Inter-American Regional Office, Public Roads Administration.

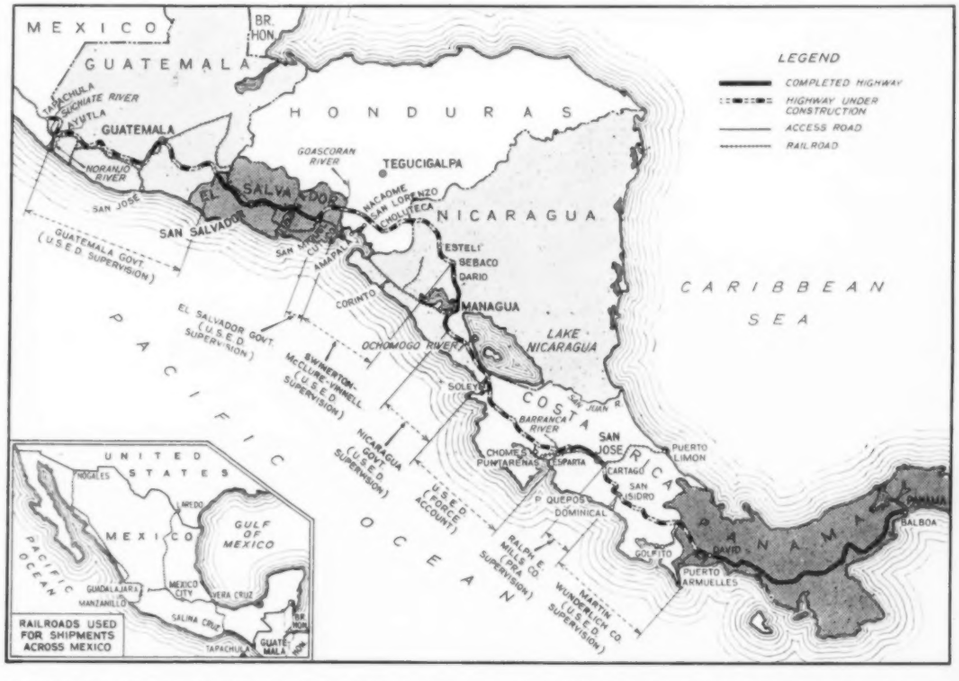
IN JUNE AND JULY, 1942, the United States Government, through appropriate authorities, decided to expedite the completion of those sections of the Inter-American Highway between the southern Mexican border and the Panama Canal Zone which had not up to that time been improved. The work, as finally undertaken, involved the construction of some 1,311 km. of pioneer road, having a minimum width of surface of 10 ft. composed of 8 in. of compacted gravel or crushed stone, without artificial binder. The width of grade was to be a minimum of 12 ft. in mountainous sections and 14 or 16 ft. in plains sections, depending on the topography. In addition, a section in Costa Rica about 94 km. in length already under construction was to be continued through the roughest mountain terrain in Central America, in accordance with the standard plans for the Inter-American Highway. These standards called for a 6-m. (20-ft.) surface with a bituminous binder, 1-m. shoulders and a maximum of 7 percent compensated gradient. Transition curves and super-elevation are required on the standard section.

Pioneer Road

The pioneer road is being constructed under direction of the Corps of Engineers, U. S. Army, and the standard road and structures by the U. S. Public Roads Administration, in cooperation with the several Central American Republics. Private contracts were made with the Foundation Co., of New York, Martin Wunderlich Co., of Jefferson City, Mo., Swinnerton, McClure & Vinnell, of San Francisco, and Ralph E. Mills Co., of Frankfort, Ky., for road construction; and with the Frederick Snare Corp. for bridge structures and steel erection. Bridge steel was fabricated by contract by the United States Steel Export Co. According to the original program the job was to be completed by May 15, 1943, but owing to the difficulties experienced in obtaining and transporting equipment to the several countries of Central America the completion date was later changed to June 1, 1944.

In organizing the project it was obvious that nothing less than full mechanization would enable completion, even by the later date. This requirement naturally led to a second, that a great deal of the mechanical personnel should be recruited in the United States and transported to the countries from Guatemala to Panama inclusive, that is, to Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama.

Transportation difficulties were expected, but not to so great a degree as actually developed. In connection with the efforts to place equipment in the three



LOCATION INTER-AMERICAN HIGHWAY between southern Mexican border and Panama Canal Zone.

TO DELIVER SUPPLIES to dock at Dominical, Costa Rica, barges of 80-ton capacity are run up on beach at high tide, unloaded at low tide and refloated at next high tide.

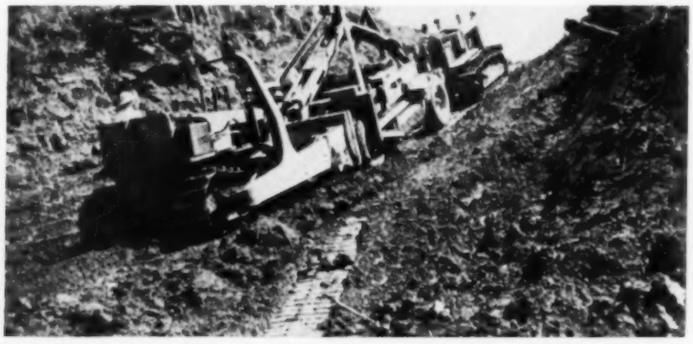
Public Roads Administration Photo

CARRYALL SCRAPER (below) is pulled and pushed up grade by Allis-Chalmers tractors after dumping material in low fill on Costa Rican section of newly constructed highway.

Public Roads Administration Photo

THATCHED-ROOFED BUILDINGS (below, left) house workmen at camp of Frederick Snare Corp., contractor, at Rio General near San Isidro, Costa Rica. Thatching is done with sugar cane leaves.

Public Roads Administration Photo



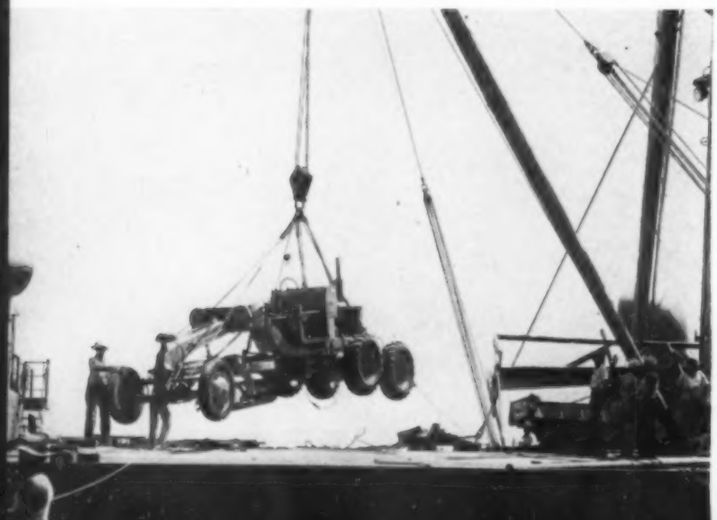
MASONRY ARCH CULVERT, 7x18 ft., serves Inter-American Highway section in Tipita, Nicaragua.

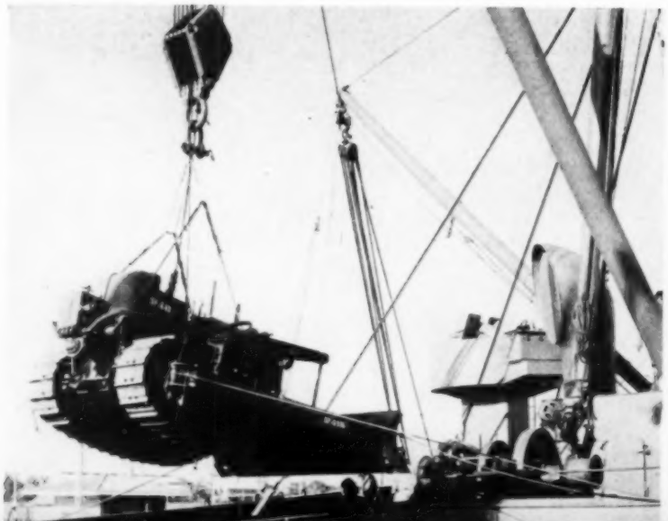
Public Roads Administration Photo

RIVER GRAVEL for surfacing work is pushed by Cletrac dozer up ramp to chute which loads waiting truck for delivery to Dominical road in Costa Rica.

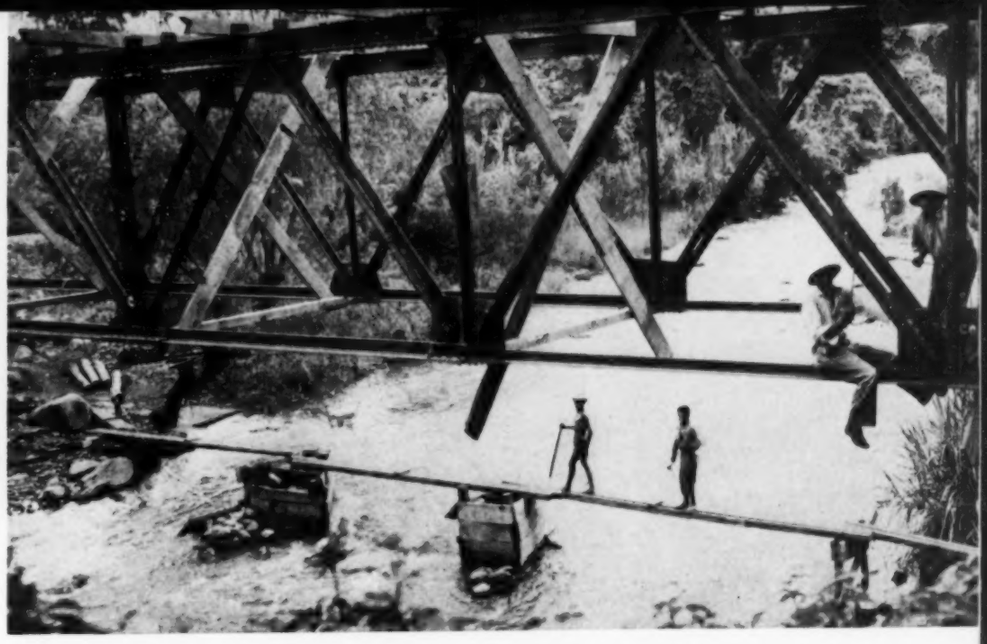
Public Roads Administration Photo

HEAVY CONSTRUCTION EQUIPMENT (below) for work on Inter-American Highway is brought to Costa Rica by 10,000-ton Liberty ship. Here Adams 12-ft. blade grader (left) and International Harvester tractor-dozer (right) are unloaded at Puntarenas.





PIONEER ROAD, built by U. S. Army Engineers, winds through mountains and forests of Costa Rica.
Public Roads Administration Photo



NATIVE RIGGERS bolt steel members of bridge over Pantaleon River, which is source of electric power supplied to nearby Nicaraguan villages.
Marine Corps Photo

northern countries, a railroad bridge was constructed over the Suchiate River between Mexico and Guatemala. This structure of creosoted pile was opened in November, 1942, which made it possible to ship by standard gage railroad to Ayutla, Guatemala. Here a transshipment station was built, consisting of a concrete platform level with the car floors, with the standard track, coming from Mexico, laid on one side and the narrow gage line (36-in.) on the other. Here freight was shifted from the standard to the narrow gage cars across the platform, with the customs checkers operating as the dollies passed. It was an efficient arrangement and permitted movement of supplies by rail from the United States to points in Guatemala and Salvador, but it was expensive because of high freight rates on both the Mexican National Railways and the International Railways of Central America.

The construction of the Suchiate River railroad bridge was undertaken jointly by the two roads concerned, with the Mexican National construction forces doing the job. By arrangement with the

(Continued on page 134)

NEAR AYATLA, in Guatemala, Caterpillar diesel tractors with LeTourneau carryall scrapers are at work. At right is sheepsfoot tamping roller.
Marine Corps Photo

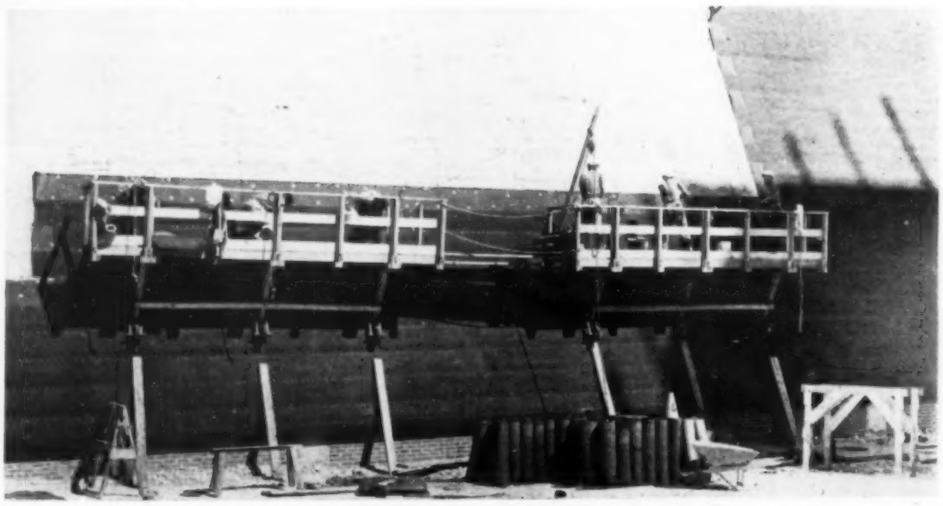
EARTH IS HAULED by crawler tractors to big fill in Costa Rica (below) by LeTourneau carryall scrapers.
Public Roads Administration Photo

PAVING MIXER (below) operates on section of highway between Chorrera and Rio Hato in Panama.
Public Roads Administration Photo

HOW They Did It

CONSTRUCTION DETAILS For Superintendents and Foremen

WATER SUPPLY SYSTEM for war housing project is installed with aid of Parsons 26-in. ditching machine as Mike Manello Co., subcontractor, Pittsburgh, Pa., digs trench for 6-in. Transite water pipe on FPHA contract of Haris Construction Co., Brooklyn, N. Y., supervised by Allegheny County, Pa., Housing Authority. Connections of asbestos-cement pipe to cast-iron specials are made with poured lead joints.



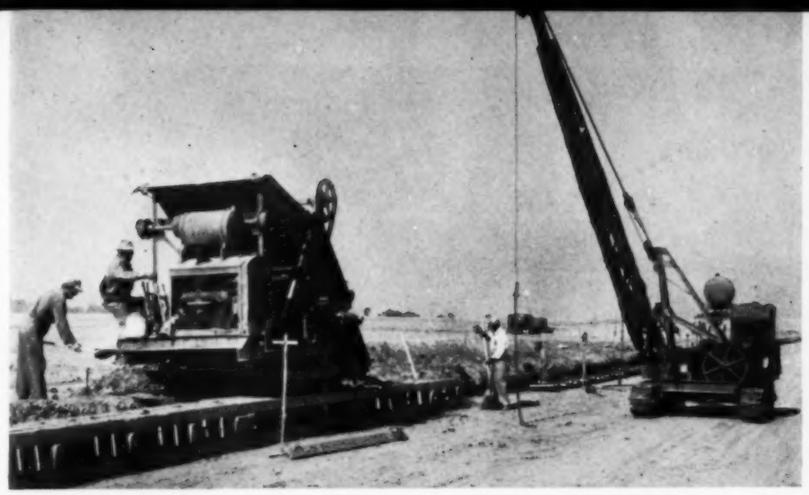
MOVABLE WORKING PLATFORMS for application of sheathing and roofing material to curved surfaces of Navy's big timber-arch blimp hangar are suspended by wire rope cables and are equipped with wheels riding on arched wall of structure.

Official Navy Photo

CLEATED BELT CONVEYOR (below), Barber-Greene portable unit, delivers 8-in. concrete blocks to masons' scaffold used in building exterior wall and firewalls about 20 ft. high for 7½-acre warehouse addition at an Ohio Army Service Forces Depot. Robert H. Evans & Co., contractor, Columbus. Scaffold is constructed of two-bay frame units which can be moved intact without dismantling any part of structure except plank runways at two levels between units.

Army Signal Corps Photo

INSULATING MATERIAL is applied to oil-spreader tank-truck during process of assembly at headquarters shops of California Division of Highways.



TIMBER CRIBBING SECTIONS laid on runway subgrade about 20 in. below shoulder level carry inside crawler track of Parsons ditching machine cutting trench for clay pipe edge drain on Covington, Ky., CAA airport. Side-boom tractor crane at right handles timber cribs. R. P. Kuehn, Green Bay, Wis., digs trench and lays pipe; Frank Mashuda Co., Milwaukee, Wis., general contractor.

OLD CONCRETE PAVEMENT on road near Creve Coeur, Ill., is loaded into truck of Standard Paving Co., Chicago, by Caterpillar diesel D4 tractor, equipped with Trackson Traxcavator.

TIMBERS ARE STACKED by Link-Belt crane (left) for handling by Tulsa winch and A-frame boom on General Motors truck (above) at U. S. Maritime Commission shipyard; McCloskey & Co., contractor, Philadelphia.

DIRECT DELIVERY by job-converted Euclid trucks takes buckets carrying 4 cu. yd. of concrete from mixing plant under head-tower to cableway hoisting falls near two-thirds point of twin cableways ½ mi. long at Norfork Dam, Arkansas, thus eliminating need for transfer shuttle car described in Construction Methods, October, 1943, p. 62, and lending further speed to concrete handling. To provide haul road for bucket-transporter trucks, monoliths totaling 1,560 ft. in length in right half of dam are leveled off 76 ft. below final height. Specially constructed lever on rear end of truck slips under bail of 4-yd. concrete bucket and raises it above ground by means of power takeoff unit. Pin inserted in vertical frame (right) is safety measure to prevent boom from dropping in transit. Four trucks on 1,400-ft. one-way haul handle output of three 4-yd. mixers for Utah Construction Co. and Morrison-Knudsen, Inc., contractors building 1,500,000-cu.yd. dam for U. S. Engineers

Post-War Highways

CONSTRUCTION is the controlling force in the economic structure of the nation.

In the last depression, production of consumer goods dropped relatively little, with an increase of unemployment of only 13 percent from 1929 to 1932. Construction contracts, however, upon which durable goods production is largely dependent, took a sharp dive, carrying durable goods with it. The unemployment increase in construction was 61 percent. Production of durable goods, almost exactly paralleling the drop in construction, was reduced in volume by 75 percent in the same period, with unemployment increasing by 53 percent.

With an estimated readjustment of the labor force after the war amounting to twenty or thirty million people, construction and durable goods production must be established at a high level, according to the findings of the American Road Builders' Association. Otherwise a depression will result. Durable goods production includes machinery, motor vehicles, railroad rolling stock, non-fuel mining, and similar items, and the wide variety of materials used in construction such as cement, lumber, brick, other clay products, lime, asphalt, and the finished products including highways, bridges, viaducts and buildings. Consequently, in peacetime, construction constitutes the foundation of the durable goods industry. Its wide use of materials and equipment affects nearly every item included in durable goods production.

Private construction in normal times provides the bulk of the construction contracts. However, private construction is variable and uncontrollable. Public works construction is flexible and can be adjusted readily to fit employment needs. Because of the widespread highway needs, and the ability to get highway projects under way more rapidly than other types, highway construction has been, and should continue to be, the leading public works activity.

CHARLES M. UPHAM, author of the accompanying article, is engineer-director of American Road Builders' Association, Washington, D. C. Post-war planning was featured at annual A.R.B.A. convention in Chicago this month.

Financing Post-War Highway Programs

With the development of post-war highway programs by states, counties and cities, the question of financing this work becomes increasingly important. Unquestionably federal aid will figure substantially, as it is unlikely that, with decreasing motor vehicle revenues for the duration, there will be sufficient reserve funds to finance the needed program.

The question comes up of the feasibility of financing a certain portion of the program at least by the sale of bonds. The trend of this method of financing by state highway departments has been downward in recent years, the peak having been reached in 1930 with a total of $222,000,000. This dropped to $28,000,000 in 1933. Recent financing by state highway departments by the sale of bonds has been as follows:

1938	$ 57,000,000
1939	62,000,000
1940	64,000,000
1941	32,000,000
1942	6,000,000

Bonding for highway construction was initiated even before the advent of the automobile. Massachusetts, New Jersey, and New York obtained highway revenue from this source in 1894. The first automobile registration took place in 1895, with four vehicles reporting. The demand for highways increased as automobile registrations soared and from 1895 until 1930 each year marked an increase in motor vehicles ranging from five to 85 percent.

Highway income was largely derived from property taxation until gasoline taxes and registration fees replaced it. Income was insufficient in many states to carry on a highway improvement program of adequate size from current income to take care of the fast increasing highway demand. Taxes would have had to be increased to unbearable proportions to obtain the necessary income in many states. Bonding was the only method which would provide funds for the immediate construction of the mileage required. If this early improvement had been carried on over a long period of years, the excessive use of inadequate highways would have resulted in wasting huge sums of money on the maintenance of roads of low quality, thus paying for them without really having them.

Bonding Plan Proves Successful

The states that were hard-pressed to provide facilities included California, Illinois, Maryland, Massachusetts, Michigan, New Jersey, New York, North Carolina and Pennsylvania. These states resorted to bond financing for highways when it was found that current revenues were insufficient to provide highway transportation to meet the immediate economic needs. The pay-as-you-go method of financing in any of these states would have delayed the use of needed highways for many years, retarded the automobile industry and delayed the economic development of the states.

The bonding plan has proved successful where there is immediate need for facilities, where highways are so bad that motor vehicle operation is not economical, where time losses and accidents are excessive and where maintenance costs have become excessive. In some states strict adherence to pay-as-you-go financing resulted in piecemeal construction, with gaps in the proposed system left until funds were accumulated to close them. This resulted in restricted use of the connecting system until the last gap was eliminated. If each link of the system could have been immediately completed, the benefits from the use of it would have been felt at once. Bonding would have furnished the necessary funds.

It is certain that if no bond financing for highway and bridge facilities had been done the nation's highway transportation system would have been far behind its present status of improvement. During the twenties when motor vehicles were increasing approximately 2,000,000 per year, states which did not meet this increasing demand for highways did not have the rapid increase in motor vehicle registrations and resulting business benefits which occurred in states which had

Should Be Planned and Financed NOW!

By CHARLES M. UPHAM, Engineer-Director, American Road Builders' Association, Washington, D. C.

provided the needed highway facilities.

Several years ago a study of highway financing was made by the highway finance committee of the American Road Builders' Association. This included a study of financing methods in Georgia, Virginia and North Carolina. The first two states had financed from current revenue and North Carolina from bonding.

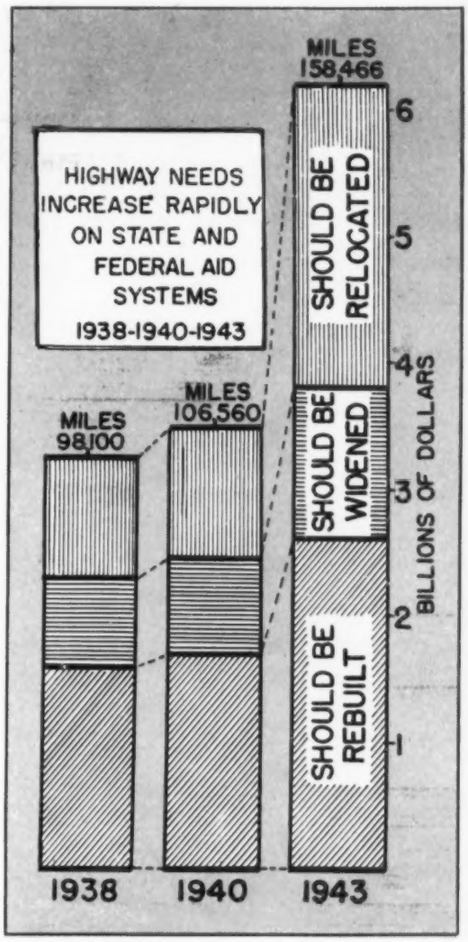
The advantages of the immediate construction of a connecting system of highways to meet a pressing demand was proved in North Carolina. The completion of the primary highway network reacted immediately on automobile registration. In 1919, just prior to the beginning of the construction program, there were 125,000 motor vehicle registrations in Georgia, 105,000 in Virginia and 65,000 in North Carolina. In 1929, as the program closed in, registrations in North Carolina had increased to 450,000, exceeding Virginia by 100,000 and Georgia by 150,000.

In 1920 there were 17 people per car in Virginia, 20 in Georgia and 31 in North Carolina. In 1928 there were 10 people per car in Georgia, seven in Virginia and six in North Carolina. In the 1919-1928 period North Carolina built 3,500 mi. of hard surface pavement, Virginia 1,600 mi. and Georgia 900 mi. North Carolina's very rapid completion of a connecting system of highways was responsible for the higher rate of increase in automobile registration as compared to the other two states and proved that this increase is a function of highway improvement.

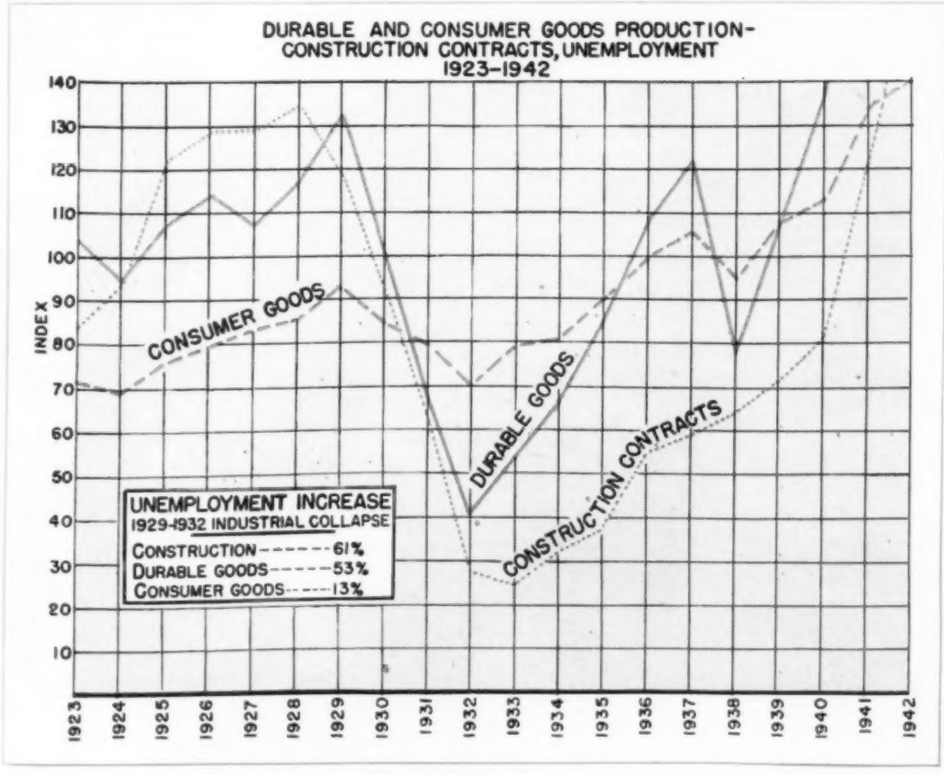
Without the bond issue, less than one-half the mileage would have been built in North Carolina during the 1919-1928 period and while the registration trend might have paralleled that of Georgia and Virginia it would hardly have exceeded it. The resulting increase in income from registration fees and gas taxes met the servicing requirements of the bonds. The savings in operating costs by reason of driving over improved highways, figured at a cent a mile, amounted to an estimated $30,000,000 annually which was more than the motorists paid to the state in gas tax and registration fees. The state got the use and the benefits immediately from a highway system which, had it been financed by current income, would have been built piecemeal and would have taken ten years longer to complete. The extra cost was justified.

The great advantage of bond financing lies in the immediate availability of the project. It has been successful in states which have large planned programs, thus permitting big contracts and low prices. Since all of the states are out of the initial road building stage, bonding in

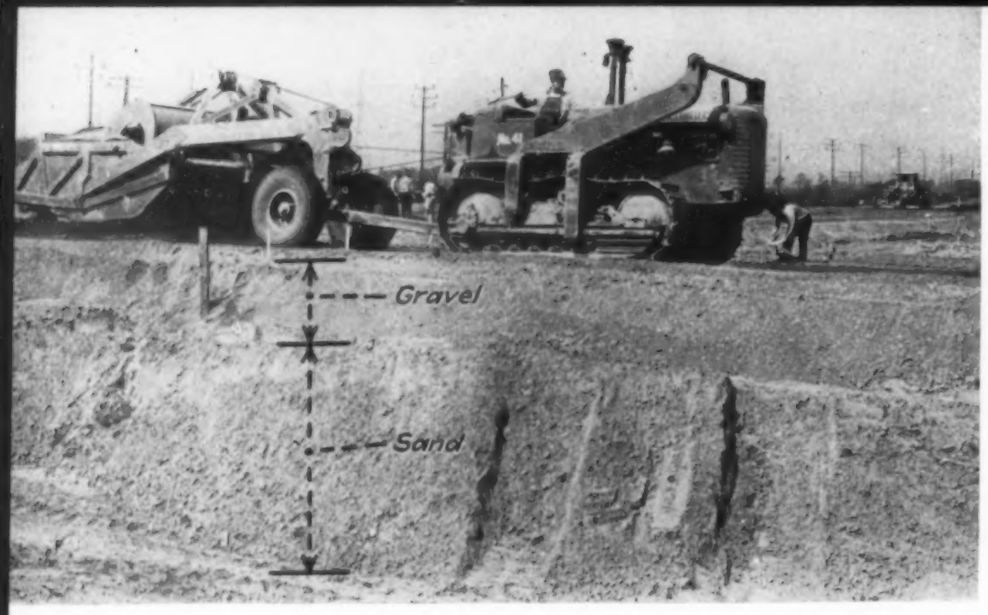
(Continued on page 124)



RESULT OF SURVEYS of needed work on state highway systems, made by American Association of State Highway Officials in 1938, 1940, and 1943, is shown by this chart. In addition, 30,000 bridges need widening or rebuilding at cost of $800,000,000.



CONSTRUCTION COMPOSES major portion of durable goods production, so both rise and fall in almost parallel chart lines. Consumer goods production tends to maintain a fairly high average. Therefore, when general letdown threatens, stabilization or upward adjustment of construction program would support durable goods production. This would stimulate production of consumer goods and likelihood of depression would vanish.



SPREADING FIRST 5-IN. LAYER of stabilized gravel on embankment built up of bank-run sand in bottom lift and bank-run gravel in intermediate course. 15-yd. Gar Wood scraper hauled by Allis-Chalmers tractor takes material from truck-dumped pile and distributes it to proper depth for compaction.

FLEXIBLE PAVEMENT on Sound Base Provides Durable *Test Track for*

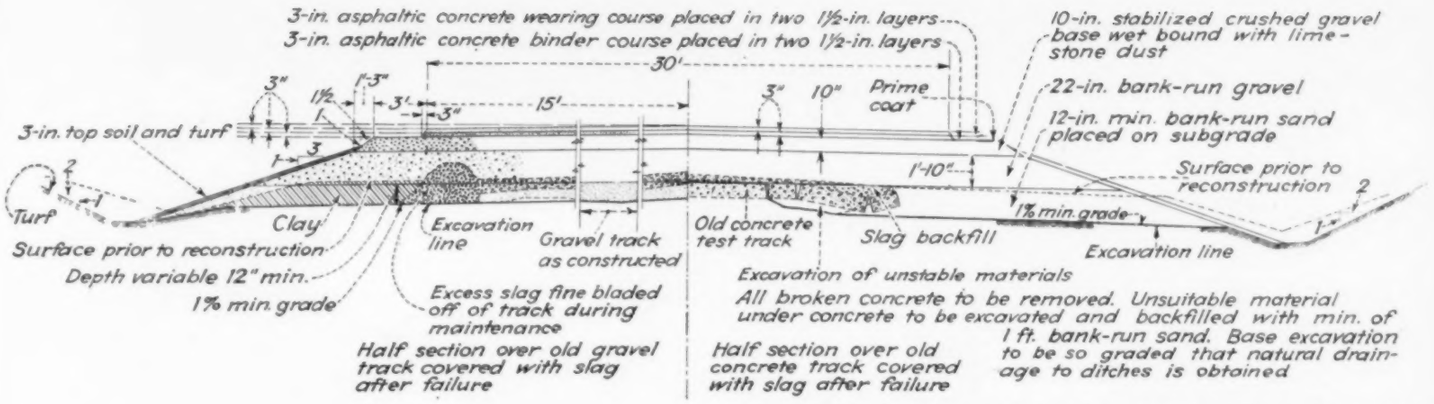
MOTOR PATROL GRADER, a Caterpillar unit, shapes stabilized gravel layer under watchful eye of HENRY C. BAER (at left), superintendent, Cooke Contracting Co., in charge of job for contractor.

EXTENSIVE EXPERIENCE by the Army Ordnance Department and by the U. S. Engineers, construction agency for Ordnance and all other branches of the Army, has demonstrated that the most durable track for the testing of army tanks consists of a flexible pavement on a stable, well-drained foundation, as exemplified by a track nearly 1½ mi. long recently completed at the Detroit (Chrysler) tank arsenal by the Cooke Contracting Co., Detroit, Mich., in accordance with designs and field direction of the Corps of Engineers. For this track, the constructors built up an embankment of 44-in. minimum depth as illustrated by an accompanying cross-section drawing, and on top of this foundation placed 6 in. of hot-mixed, hot-laid asphaltic concrete in four 1½-in. courses. A second drawing shows the figure-eight layout of the track, particularly interesting for the sharp (almost right-angle) turns at one end. Track pavement, 30 ft. wide on straightaways, is widened and superelevated at the curves.

Experience at a number of locations with various types of tank tracks has furnished convincing evidence that a flexible pavement, adequately supported by a dependable base, pro-

LIMESTONE DUST (below) is mixed into top 5-in. layer of stabilized gravel. Moist condition of material indicates that sprinkler truck is applying water during this operation. Tractor-powered rotary tiller is used for mixing limestone dust and gravel on part of track.

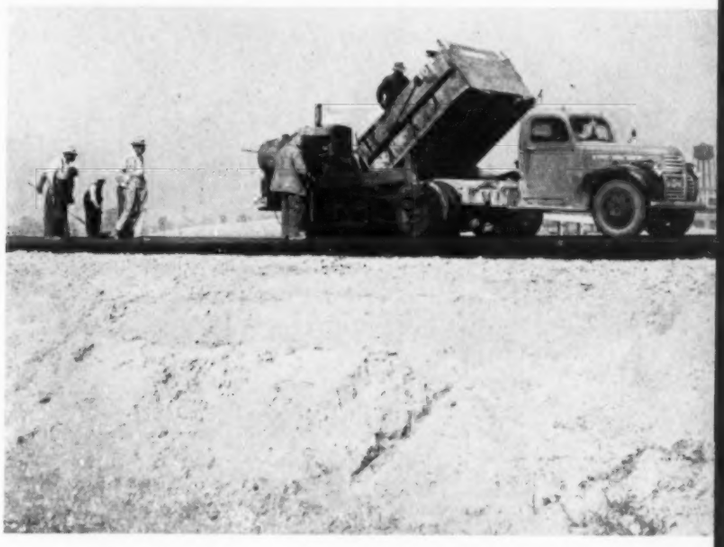
SHEEPSFOOT ROLLER (below) compacts top layer of stabilized gravel wet-bound with limestone dust for base of flexible pavement.


3-in. asphaltic concrete wearing course placed in two 1½-in. layers
3-in. asphaltic concrete binder course placed in two 1½-in. layers
10-in. stabilized crushed gravel base wet bound with lime-stone dust
22-in. bank-run gravel
12-in. min. bank-run sand placed on subgrade
30'
15'
3"
10"
Prime coat
3-in. top soil and turf
Surface prior to reconstruction
1'-10"
1% min. grade
Turf
Clay
Surface prior to reconstruction
Depth variable 12" min.
1% min. grade
Excavation line
Gravel track as constructed
Excess slag fine bladed off of track during maintenance
Half section over old gravel track covered with slag after failure
Old concrete test track
Slag backfill
Excavation line
Excavation of unstable materials
All broken concrete to be removed. Unsuitable material under concrete to be excavated and backfilled with min. of 1 ft. bank-run sand. Base excavation to be so graded that natural drainage to ditches is obtained
Half section over old concrete track covered with slag after failure

TEST TRACK to take pounding of Army's M-4 medium-tanks comprises flexible asphaltic concrete pavement 6 in. thick on stabilized base forming top lift of embankment of 44-in. minimum depth. Half-sections show embankment construction over abandoned gravel and concrete tracks, encountered on long stretches of new track location.

Army Tanks

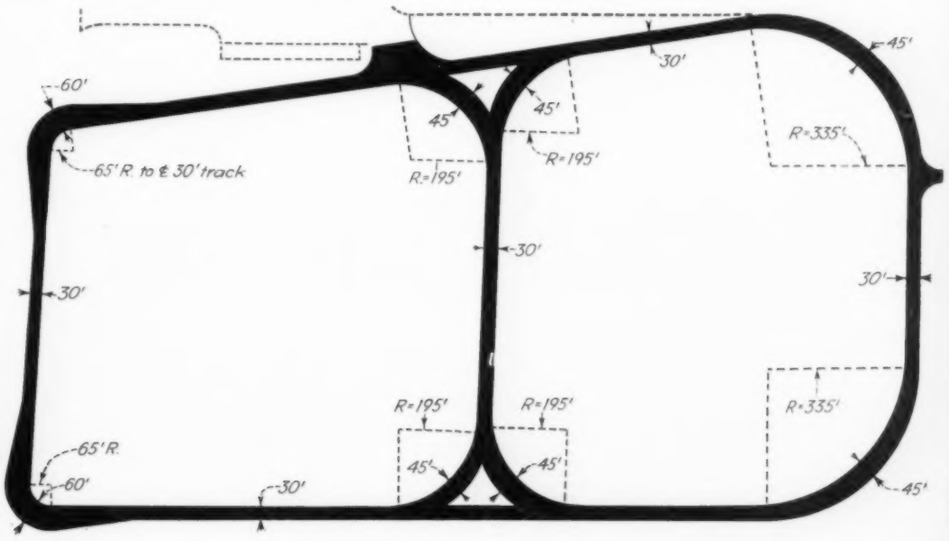
vides the only roadway capable of taking the pounding of heavy track-type armored units, whether steel-shod or rubber-shod, without eventual failure. By virtue of its ductility, a flexible bituminous pavement is able to adjust itself to the heavy blows of tanks without any break in the pavement surface; if prolonged traffic causes a rut in one part of the pavement, the depression can be corrected merely by diverting the traffic to a new channel. Use of a relatively soft asphalt saves the pavement from becoming brittle through complete loss of ductility, even in cold winter weather. The collateral possibility of minor surface rutting in hot summer months presents no obstacle to continuous use of the track. To avoid raveling or pitting of the surface through dislodgement of stone, an aggregate of small size (100 percent passing the ½-in. screen) has proved best in the wearing course. This

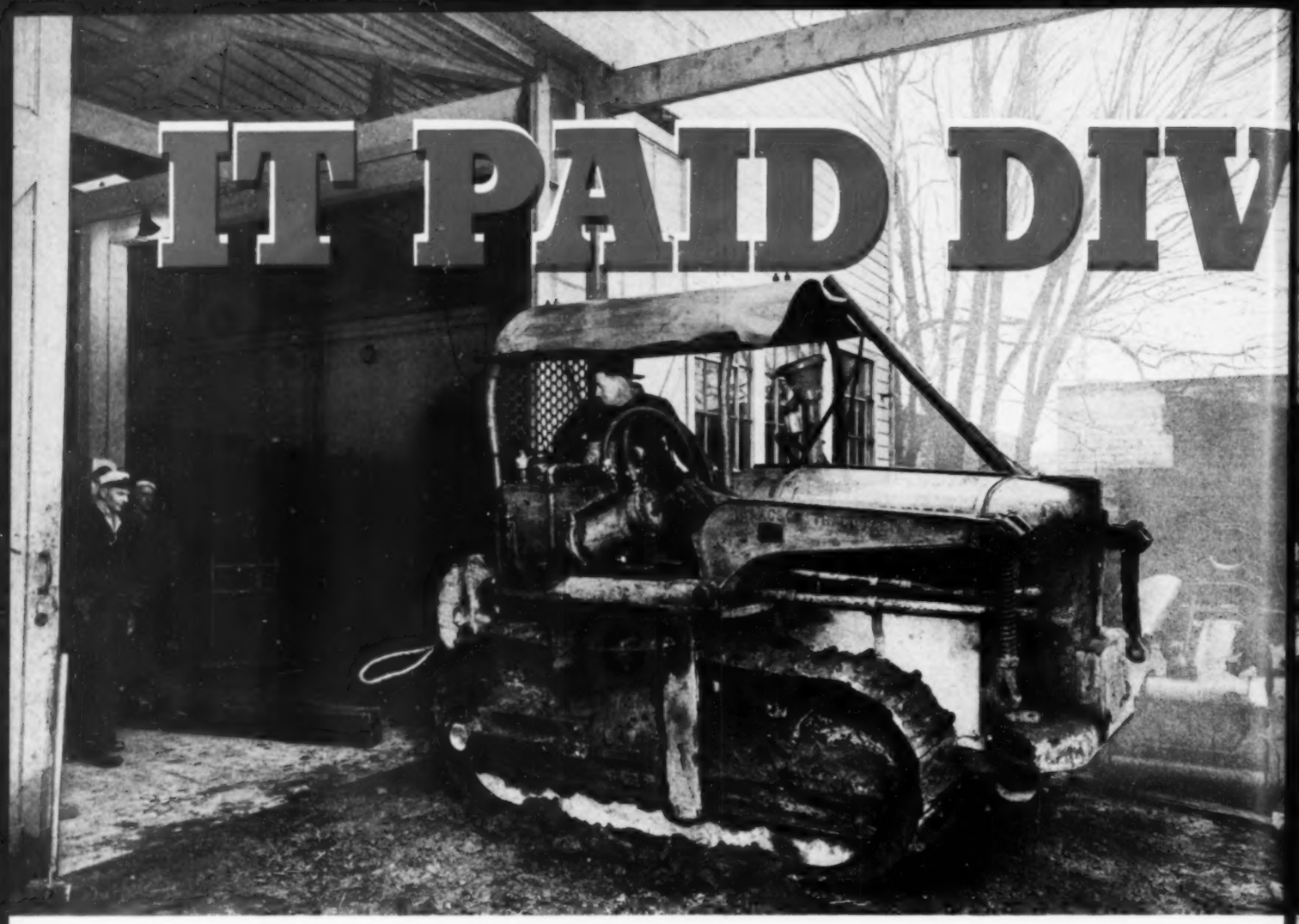


ON STABILIZED BASE at top of built-up embankment, asphaltic concrete pavement is laid in four 1½-in. courses by self-propelled Adnun spreading-finishing machines. Paver here is placing truck-delivered hot material in final layer of 6-in. pavement.

TRACK CONSTRUCTION (left) is supervised by J. H. (Jack) HOHNKE (left), general superintendent, Cooke Contracting Co., and P. H. WILLIAMS, project engineer, U. S. Engineers.

TRACK LAYOUT (below) bearing rough resemblance to figure eight has total length of 7,720 ft., of which 5,800 ft. is in outside loop. Note two short curves at left (west) end of outside loop, designed to reduce wear on brake bands of tanks using track. Pavement 30 ft. wide on tangent and up to 60 ft. wide on superelevated curves requires 30,000 sq. yd. of hot-mixed, hot-laid asphaltic concrete.





IT PAID DIV

Proves Worth While To Have Tractor Repaired In Dealer's Shop

Salem Sand & Gravel Co., big-time contractor operator in Salem, Oregon, received a tip that really paid off when they called Walling Tractor & Equipment Corp., Allis-Chalmers dealer at Portland, Oregon, for a service man to make adjustments on its 2-Cycle Diesel tractor.

Knowing that the tractor had been run steadily on tough work for several years without an overhaul . . . Walling suggested that it be taken into their up-to-date shops for a complete check-up — where special tractor tools and a skilled crew of mechanics were right on hand. He also suggested that the tractor operator accompany the unit to approve the work and to pitch in and help — thereby cut the time and cost of the job and learn more about the outfit he was running.

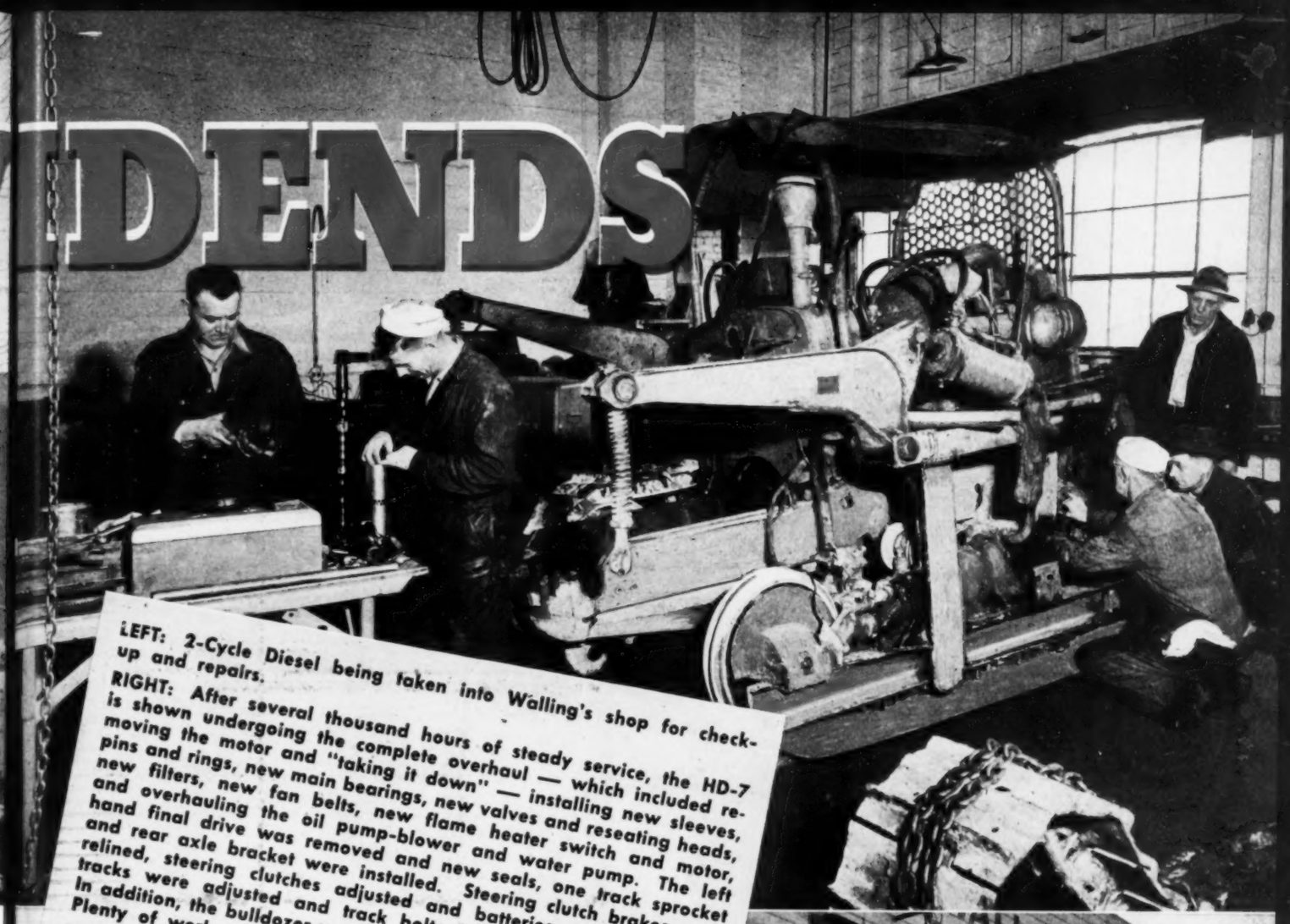
This contractor immediately saw the advantages of having the job handled this way and readily agreed. That it paid dividends is shown by the amount of work the tractor required (see caption) and the short time in which it was accomplished — only 3½ days — regardless of the shortage of manpower and critical materials. Now it's performing like a new unit — paying off for the work done.

It will pay you dividends, too, to have major repairs handled in your A-C dealer's shop. Like Walling Tractor & Equipment Corp., your Allis-Chalmers dealer is fully equipped to help you. Let him put your outfits in A-1 condition . . . get peak performance NOW!

ALLIS-CHALMERS

TRACTOR DIVISION · MILWAUKEE, U. S. A.

VIDENDS

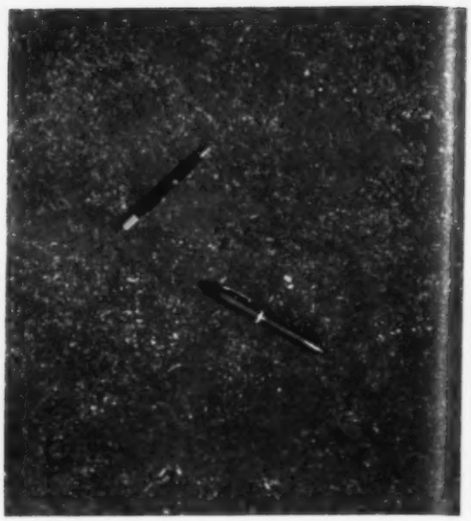


LEFT: 2-Cycle Diesel being taken into Walling's shop for check-up and repairs.

RIGHT: After several thousand hours of steady service, the HD-7 is shown undergoing the complete overhaul — which included removing the motor and "taking it down" — installing new sleeves, pins and rings, new main bearings, new valves and reseating heads, new filters, new fan belts, new flame heater switch and motor, and overhauling the oil pump-blower and water pump. The left hand final drive was removed and new seals, one track sprocket and rear axle bracket were installed. Steering clutch brakes were relined, steering clutches adjusted and batteries recharged. The tracks were adjusted and track bolts installed, where necessary. In addition, the bulldozer was repaired and logging drum tightened. Plenty of work to get done in 3½ days!

BELOW: It leaves the shop, ready to perform with the efficiency of a new outfit.

HOT WEARING COURSE MIXTURE containing aggregate of ½-in. maximum size is dumped by truck into hopper of spreader-finisher, which pushes truck ahead as paving proceeds while load is discharged.



FRESHLY ROLLED FINAL LAYER of asphaltic concrete pavement reveals dense, coarse surface texture obtained with mixture containing ½-in. maximum size aggregate and 6.2 percent bitumen.

CENTRAL 10-FT. LANE of 30-ft. pavement is placed by spreading-finishing machine. Two front wheels of machine travel on layer previously laid; rear roller wheels are supported on freshly leveld material.

size aggregate was used in the top 3 in. of the pavement at the Detroit tank arsenal, and the asphaltic concrete for the full depth of the pavement was made with an 85-100 penetration asphalt meeting the 85-95 specification for the job.

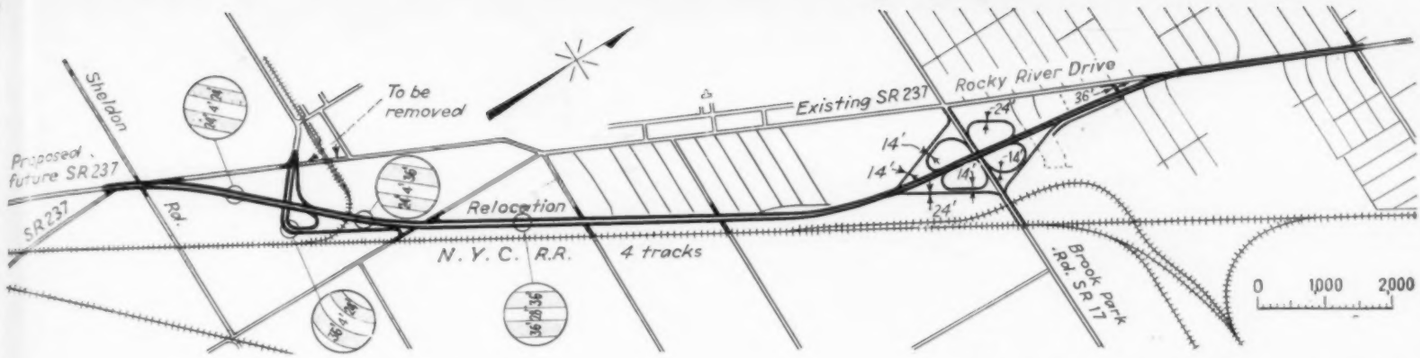
Foundation Design—Embankment for the test track was built on several kinds of subgrade. Two types of test tracks, one of gravel and the other of concrete, had been in use for some time on the two halves of the site. For about 60 percent of its length, the new track coincides in location with the gravel track, which had been built up with slag after failure. Of the remainder of the new construction, about 600 ft. was on the line of the former concrete track, which had been punished to destruction by tank traffic and covered with slag. Both of these conditions are indicated by half sections of the accompanying cross-section drawing.

New embankment was built up on top of the existing tracks, as shown, and on natural clay grade. Where concrete pavement had broken up and disintegrated, the shattered slab was removed, and all unstable material was excavated to permit placing a minimum of 12 in. of selected bank-run sand as the first layer of embankment. In the portions occupied by gravel track, only unstable material was removed; no necessity existed for removing the gravel, slag or clay berm. The bottom layer of bank-run sand served as a grading course for the embankment, and the sand was deposited in varying depths of

(Continued on page 102)

TANDEM 10-TON ROLLER compacts hot material behind paving machine. Two such rollers compress asphaltic concrete in each 1½-in. layer and iron out joints between paving lanes. This pavement is on outside loop at Y, as indicated by connecting road in left background.

PARKING AREA (below) for tanks shows marks of track grousers but no damaging effects after three weeks of continuous use in September. Parking strips on bituminous pavement generally show first wear. This strip is part of 45-ft. pavement on curve at Y.



TO FACILITATE TRAFFIC FLOW into and out of industrial plants served by highway spur near south end of project, Ohio Department of Highways builds 3½-mi. relocation with grade-separation bridges at two interchanges, one a full clover-leaf. Varied pavement widths roughly indicate ratios of traffic concentrations carried by divided roadways and interchange connections.

CONCRETE PAVING JOB USES *Air-Entraining Cement*

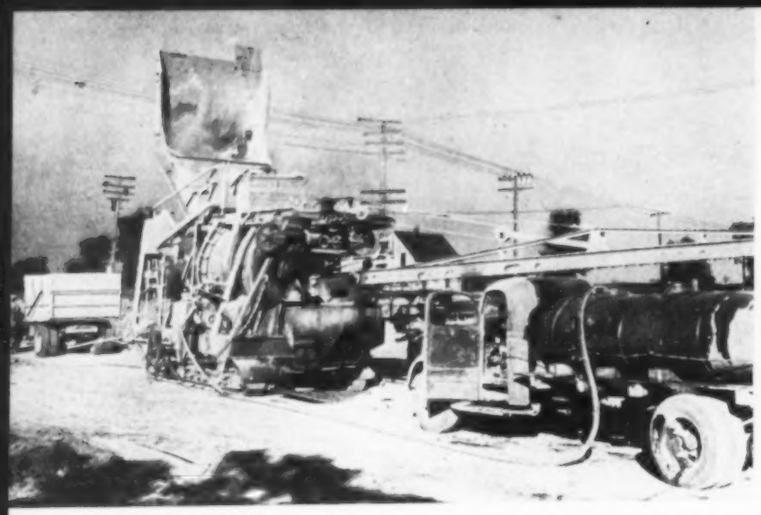
CONCRETE PAVING METHODS developed through years of experience on projects using standard portland cement served equally well in construction by the Horvitz Co., contractor, Cleveland, for the Ohio Department of Highways, of 187,000 sq.yd. of non-reinforced pavement containing air-entraining cement on a 3½-mi. relocation of State Route 237 designed to provide improved access to industries west of Cleveland. Only minor modifications were necessary in adapting tested methods to the placing and finishing of concrete made with a cement which entrained minute air bubbles. A portland cement containing a very small percentage of Vinsol resin to provide the desired air-entraining capacity was specified by the Department of Highways in order to increase the durability and resistance to scaling of concrete slab which would be subjected a number of times each winter to applications of chemical salts or chemically treated abrasives.

Divided, multiple-lane pavement and two traffic interchanges, one of them a full cloverleaf, with a grade-separation bridge at each interchange, characterize the highway improvement, shown on an accompanying plan which indicates the varying widths of pavement. Rapid construction was especially desired to relieve traffic congestion on the access route at hours of shift changes in the industrial plants. Signing a $1,300,000 contract for the project late in March, the contractor put on the job a capable organization and sufficient well-maintained equipment to insure completion of the pavement considerably in advance of January 1, the date stipulated by the contract. Final dressing of the job, including seeding and sodding, will be completed well ahead of the specified date, June 1.

Contract Quantities

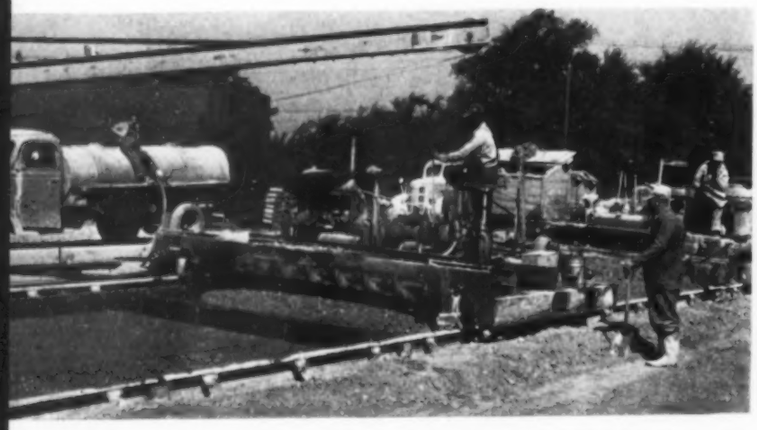
In addition to 187,000 sq.yd. (47,000 cu.yd.) of pavement slab, plus 17,000 lin. ft. of integral 4x6-in. curb, the contract involved 6,200 cu.yd. of concrete in structures, 156,000 cu. yd. of excavation, 203,000 cu.yd. of common borrow, and more than 90,000 cu.yd. of classified granular

FOLLOWING DUAL-DRUM PAVER (below), array of spreading and finishing equipment comprises screw spreader, two-screed finishing machine, joint machine, long-handled straightedges, burlap drag, rolling bridge, and portable power pump outfit to apply curing compound. Workmen at right are erecting 4-in. added lift of forms for 4x6-in. integral rolled curb, used where divided roadways approach each other closely, with 3 ft. or less between them.

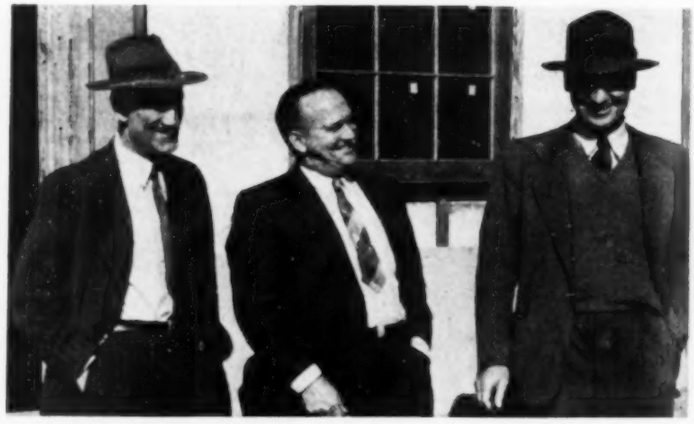


TRAVELING OUTSIDE FORMS. 34E dual-drum mixer is supplied with water by two 1,200-gal. tank trucks hauling from nearby hydrants. Three-batch trucks haul 36-cu.ft. dry batches.

SPECIAL WOODEN TEMPLATES (right) equipped with adjustable vertical bolts assure accurate setting of flush expansion joints. Templates are built for every width and transverse profile of pavement, and each unit is plainly marked. As premolded joint filler is not available in lengths exceeding 12 ft., spliced extensions are added to 10-ft. pieces for paving lanes more than 12 ft. wide.



AS SCREW SPREADER approaches expansion joint, screw is raised to clear joint. Paver operator will straddle joint with next batch of concrete to provide support on both sides of filler material.



THREE-POWER CONFERENCE by staff of the Horvitz Co., contractor, calls these men together: (Left to right) E. C. BLOSSER, chief engineer; T. W. KINNEAR, construction engineer; ALVIN KOHN, general superintendent.

ON SECOND PASS (left), finishing machine is followed by joint machine which also operates reciprocating screed over surface of concrete pavement.

borrow for pavement subgrade. The granular borrow was placed in a compacted 12-in. base.

Concrete for pavement was mixed by a 34E dual-drum paver, which turned out 36-cu.ft. batches, while a 27E single-drum mixer produced concrete for bridges. Five tractor-scraper outfits, 8- to 15-yd., and two 1¾-yd. shovels worked on borrow excavation and grading, aided by two 1¼-yd. crawler cranes equipped part-time as draglines. Three bulldozers and three 12-ft. motor patrols

FOR SMOOTH FINISH (below), adjacent to expansion joint, finisher uses steel float. Long-handled floats are required only on limited areas of pavement surface, most of finishing in this phase of operations being accomplished with long-handled steel straight-edges.

TO MAKE SPREADER ADJUSTABLE (below) to varying pavement widths from 12 to 14 ft., frame and shaft extensions are added at one side of machine. Wheels fit on keyed shaft extensions equipped with bolted collars to facilitate adjustment in positions of wheels. Finishing machine is similarly equipped.

likewise operated on grade building. Ahead of and behind the dual-drum mixer, the contractor put fine-grading and finishing equipment adequate to keep up with concrete production.

Air-Entraining Cement

Portland cement used on the job contained an average of about 0.037 percent of Vinsol resin interground with the clinker at the cement mill. This proportion of Vinsol caused the introduction of about 3 percent of minute air voids into the concrete, reducing the weight of the slag-aggregate concrete about 4 lb. per cu.ft. The cement factor was 6 sacks per cu.yd., the same as for standard portland cement under Ohio specifications. Cylinder tests of concrete on this project indicated strengths in excess of specification requirements. Favorable results obtained on a test road built by the Ohio Department of Highways, together with tests made by the testing laboratory prior to 1943, justified the use of air-entraining cement in the construction of concrete pavements during 1943.

Because air-entraining portland cement flows much more readily than standard cement, special precautions were taken to prevent loss in transit on the batch trucks. Each truck carried three batches. To dam the cement against flowing from one batch compartment to another, the sand on top of the slag in each compartment was shaped with a shovel to form a dished depression for the cement. As a safeguard against loss by blowing, the cement was covered with a tarpaulin.

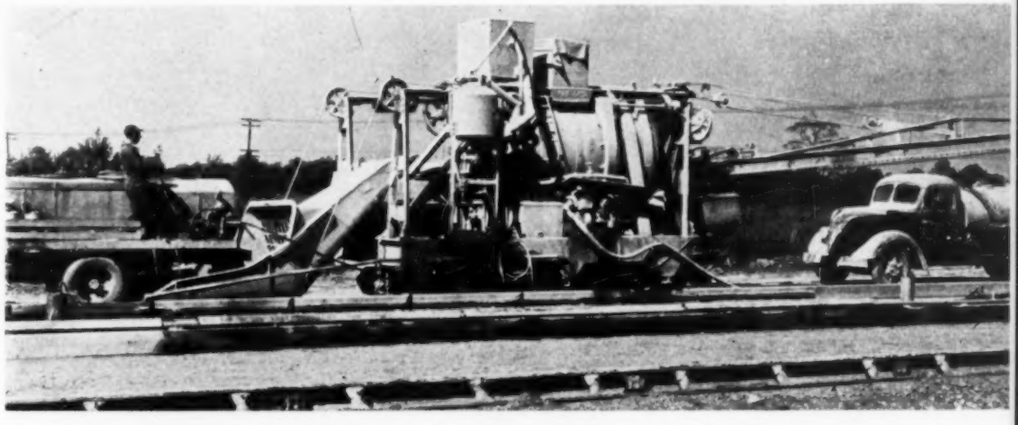
Handling Concrete

Mixing of the concrete introduced no complications. The total mixing time for each batch in the two-compartment drum, from skip-up to discharge, was 80 sec. This mixing period did not cause any excessive formation of air voids, a

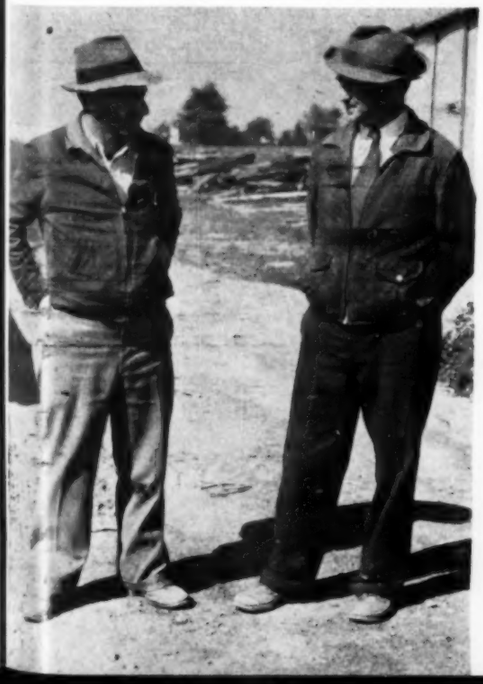
(Continued on page 153)

FOR OHIO HIGHWAY DEPARTMENT, field operations are under direction of **WALTER ANDERSON,** project engineer.

1¼-YD. CRAWLER CRANE speeds transfer of paving equipment from one lane to another. Lorain crane here is moving concrete spreading machine.



AT NOON SHUTDOWN of 30 min. for lunch, fuel and oil truck at left refuels 34E dual-drum mixer. Other equipment on job is supplied during same period. Truck carries both gasoline and diesel fuel.



CONCRETE AND EARTHWORK are handled for contractor by **WILLIAM SMITH** (left), in charge of paving, and **CARL H. HEINZERLING,** in charge of grading.

AS INSURANCE AGAINST DELAY (right), dual-drum mixer carries reserve water pump, partly covered at right. Pump at left transfers water from tank truck to receiver on mixer.

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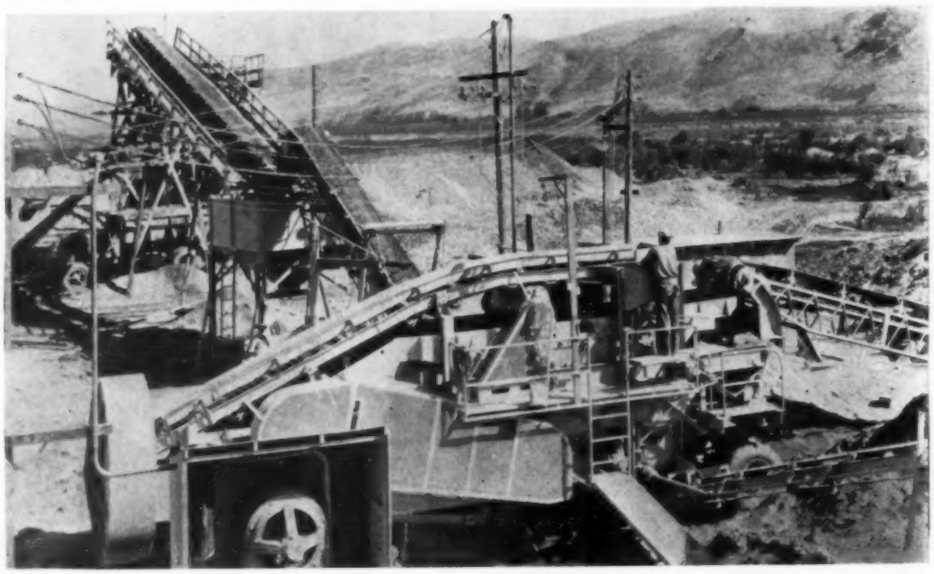
CONSTRUCTION EQUIPMENT NEWS

FEBRUARY, 1944 REVIEW of Construction Machinery and Materials



PORTABLE CRUSHING PLANT with high capacity and mobility handles both gravel and rock. Overall traveling dimensions are 33 ft. 5 in. long x 8 ft. wide x 12 ft. 10 in. high. Rides on six cast disk wheels equipped with dual pneumatic tires and four-wheel brakes. Consists of matched output jaw and roll crushers, screen and conveyors, which are perfectly balanced to eliminate any bottleneck in high capacity production. Power losses and maintenance have been reduced to minimum with power transmission system that utilizes no chains, sprockets, or flat belts. Guarded multiple-V belts, universal shafts, inclosed oil-bathed gears, and anti-friction bearings are used throughout, so only 125 to 150 hp. is required to operate plant at peak capacity. Handles material in continuous flow from shovel to truck or storage. Can be used for quarry work by placing primary crusher ahead of master unit. Becomes heart of complete crushing, washing, and screening plant when sprays, washing screen, and settling tank are added.—**Iowa Mfg. Co., Cedar Rapids, Iowa.**

★ ★ ★

Kentucky Airport

(Continued from page 66)

shift, the excavating equipment moves 35,000 to 40,000 cu. yd. per day.

Gravel and sand for runway construction are obtained from two pits alongside the Ohio River about 4 mi. from the airport site. Early in the job, two Universal crushing and screening plants with rated capacities of 150 tons per hr. produced all the sand-gravel required for the 10-in. stabilized base course of the runway. This material, amounting to about 230,000 tons, was stockpiled for use as needed by two stabilizer plants, at the airport site, which mix clay with the sand-gravel.

To turn out the necessary aggregate for the asphaltic concrete binder and surface courses, only one of the two crush-

(Continued on page 88)

10 Reasons WHY OWNERS PREFER ADAMS MOTOR GRADERS

★ Some day—in the not too far distant future, perhaps—you will be able to buy motor graders to replace wornout equipment. When that day arrives keep in mind that only in Adams Motor Graders do you get *all* of the following desirable features:

1 **STRENGTH AND DURABILITY**—Adams have the strength and stamina to stand up under continuous hard work. That is being demonstrated throughout the world by our armed forces.

2 **BALANCED DESIGN**—The weight is so distributed that the blade and scarifier can exert sufficient pressure to utilize the full power and traction of the machine.

3 **POWER AND TRACTION**—All models are powered by dependable International engines with lugging ability to hang on in tough going. Suitable traction utilizes full engine power.

4 **ADAPTABILITY TO WIDE RANGE OF JOBS**—Each model, from the smallest to the largest, is adaptable to any surface, ditch or bank work of which any motor grader is capable.

5 **WIDE RANGE OF SPEEDS**—Each model has a wide range of working speeds with a high top speed for quick transport.

6 **EASY STARTING**—Press the starter button and an International Diesel engine starts as easily as the engine in your automobile.

7 **DEPENDABLE OPERATING CONTROLS**—Adams mechanical controls are always positive and operate at uniform speed regardless of how many are used at one time.

8 **ECONOMICAL OPERATION**—International engines are economical to keep up and all working parts of the grader are adjustable for wear insuring long life.

9 **WIDE RANGE OF MODELS**—The Adams line includes a size to suit your needs. (Present availability subject to wartime restrictions.)

10 **WIDESPREAD SERVICE AVAILABLE**—Adams machines are sold and serviced in every state and province of the United States and Canada and in more than 30 countries throughout the world.

Let your local Adams dealer service your present equipment regularly to keep it rolling for the duration.

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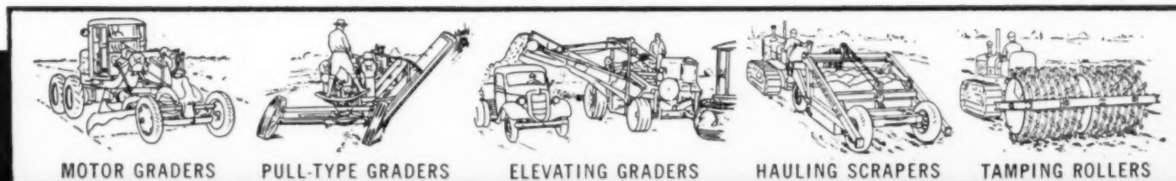

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for International Harvester TracTracTors

To establish a sloping cut . . . to peel a bank . . . to maintain a level cut when the tracks must travel on a slope . . . it's a simple matter to adjust the end tilt on the Heil Cable Dozer. Here's one more of the many features that assure high efficiency . . . through careful engineering which has accomplished perfect teamwork between tractor and dozer all along the line.

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ARMY NAVY

THE HEIL CO.

GENERAL OFFICES • MILWAUKEE 1, WISCONSIN

(*Continued from page 86*)

ing and screening plants has continued in operation. All rejected sand from the screening plants is used in the 9-in. blanket course. Including the rejected sand, the two plants have turned out more than 450,000 tons of sand and gravel aggregate for construction of airport runways.

Embankments are placed in 8-in. loose layers and are compacted with sheepsfoot tamping rollers to 100 percent of dry density as determined by the Proctor density test, A.A.S.H.O. Method T-99-38. In the shoulder areas 175 ft. wide bordering both sides of each 150-ft. paved runway, and in intermediate fill areas, the constructors are able to dispose of unsatisfactory material, such as plastic clay which can be compacted to a required 93 percent of standard dry density as determined by the same method.

Final subgrade compaction is obtained in all cases with 10-ton smooth rollers. Shale-limestone material deposited in embankments compacts to an average density of 117 lb. per cu. ft.

Compacted subgrade is constructed by the general contractor, in preparation for placement of the pervious granular subbase, on a 1 percent slope from the center line to the edges of the runway. On the compacted subgrade, the sand blanket course is dumped and spread in a single layer for compaction to full 9-in. depth.

Stabilized Gravel Base

Two continuous pug-mill mixing plants, a Cedar Rapids and a Pioneer, with respective capacities of 100 and 120 tons per hr., turn out the clay-sand-gravel mixture for runway base. At each of these plants, a Northwest crane with a 1-yd. clamshell bucket feeds aggregates and binder soil into the charging hoppers of the mixing unit.

Stabilized material for the 10-in. base course is spread and compacted in layers not exceeding 4 in. in thickness. Ordinarily the 10-in. depth is built up of a 4-in. bottom layer and two 3-in. layers. Prior to rolling, the material is wetted with a spray to retain the moisture at optimum. Each layer is compacted with pneumatic-tired rollers and 8-ton steel rollers (either tandem or three-wheel) to required density of 100 percent.

Stabilized base is finished to extremely accurate grade and surface smoothness to permit laying of the asphaltic concrete surface without grade stakes or grade lines. This procedure requires for the base a smoothness approaching the tolerance of ¼ in. in 10 ft. specified for the pavement.

On the accurately graded and smoothly finished base, primed with 0.25 gal. per sq. yd. of MC-1 cut-black asphalt applied by pressure distributor, a 2-in. binder course of asphaltic concrete is spread and

struck off by self-propelled spreading and finishing machines, two Adnuns and one Barber-Greene, to which the hot material is fed by end-dump trucks hauling from

SPECIFIED GRADATIONS ASPHALTIC CONCRETE MIXES

BINDER COURSE

Screen	*Percent passing*
1 in.	100
¾ in.	76-90
½ in.	60-79
No. 4	30-50
No. 10	20-39
No. 40	10-23
No. 80	6-15
No. 200	3-8
Bitumen	3.5-5.5

SURFACE COURSE

½ in.	100
⅜ in.	84-100
No. 4	60-73
No. 10	43-57
No. 40	23-33
No. 80	13-20
No. 200	4-8
Bitumen	5.0-6.5

STABILIZED GRAVEL BASE

1 in.	100
¾ in.	70-100
No. 4	35-65
No. 40*	15-30
No. 200	5-15

GRANULAR SUB-BASE

2 in.	100
No. 10	50-100
No. 200	0-5

* For stabilized gravel base, that portion of total blended material passing No. 40 sieve shall have a liquid limit not greater than 25 and a plasticity index between 2 and 8.

the mixing plant. Only one or two spreaders operate at a time. The same machines lay the 1-in. wearing course on top of the binder course. About 5,000 sq. yd. (500 tons) of binder is placed per day.

Specified gradations of the mixes and proportions of bitumen are shown in accompanying tables for binder course and wearing courses. Maximum aggregate sizes are 1-in. for binder and ½-in. for surface course. To assure ductility at all temperatures, a soft asphalt of 120-150 penetration is used. Actual percentages of bitumen in the two mixes are about 4.7 for binder and about 6.8 for top. Temperature of the asphaltic concrete when leaving the mixing plant is about 300 deg.

An original bid of $1,858,105.90 by the Frank Mashuda Co., based on estimated quantities, has since been increased by the addition of the fourth runway and necessary taxiways to about $2,362,000.

Personnel

In charge of the job for the Civil Aeronautics Administration, T. E. Stephenson, associate airways engineer, is resident engineer responsible for all construction operations. He is aided by L. C. Andrews and W. E. McLane assistant airways engineers. For the H. C. Nutting Co., Cincin-

(*Continued on page* 92)

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3 **ECONOMICAL HANDLING** because the speed, flexibility, and scientific weight distribution assure bigger yardage at lower cost.

4 **LESS CABLE REPLACEMENT** because rope lasts up to four times as long. Many report savings of ¼¢ to ½¢ a yard.

5 **FASTER UNLOADING**—all the load can be spread smoothly and evenly at high speed — with no sticking in the bowl, even in wet, sticky soils.

CABLE POWER *Costs Less*

Simple, fast-operating Heil Power Control Units lower operating costs

Smooth-operating brake and clutch assemblies eliminate shocks and jerks; the large drums run cool; the sheaves are designed to reduce wear on cables. This adds up to minimum outlay for cable replacement. Fingertip control gives lightning-fast response for bigger yardage.

...and that isn't all:

Heil engineering gives you all-welded construction; scientifically located draft-pivot point; ample tire clearance; and an all around design that assures you of easier maintenance and simpler field repairs.

Write for descriptive bulletins. R-22

ARMY E NAVY

THE HEIL CO.

GENERAL OFFICES • MILWAUKEE 1, WISCONSIN

WHEN THERE'S WORK TO BE DONE —IN WAR OR PEACE

YOU will find GM Diesels hard at work in every theater of the war. They power massive tanks moving into battle, heavy trucks in endless supply lines, tractors to clear landing fields, landing and assault boats, big submarines and fast subchasers in home and in foreign waters.

In every respect, these GM Diesel Engines are living up to all that was predicted for them—and more. In many instances they are doing an even greater variety of jobs than they were designed for. They are standing up under conditions that couldn't possibly have been foreseen.

When the war is over, GM Diesels will be ready to serve the peace as they are serving in war. With this difference: expanded production facilities, together with improvements and refinements in design and construction, will make them even more available for use—more capable of reliable, low-cost performance.

GM Diesels will be on hand to show that they can do an even bigger job in America's trucks. Simple in mechanical construction; sturdily and precisely built; economical in operation and upkeep, GM Diesels will prove as indispensable in peace as they are proving vital in war.

GM
GENERAL MOTORS
DIESEL POWER

ENGINES..15 to 250 H.P... **DETROIT DIESEL ENGINE DIVISION,** Detroit, Mich.

ENGINES..150 to 2000 H.P. . .CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio

LOCOMOTIVES.....ELECTRO-MOTIVE DIVISION, La Grange, Ill.

Brother... what I could do with this "putt-putt" back home

Homelite Portable Generators are affectionately known in the Armed Forces as "putt-putts". Men who see and *use* them . . . around airports, or in bombers and tanks . . . have come to know them for their dependable performance under the toughest possible conditions. Those men can see right now how ready and able these new, handy "putt-putts" will be after the war . . . for operating floodlights, electric tools, radios, signal systems and many other devices.

There's no doubt about it, ex-service men will be among the best supporters of Homelite Portable Generators . . . for right now, these "putt-putts" are supporting them, wherever they are, in every possible way.

HOMELITE CORPORATION

PORT CHESTER, NEW YORK

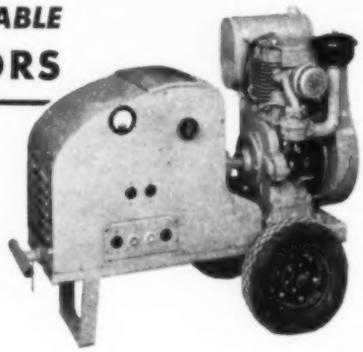
Bite? A Haiss Hi-Power will swallow our whole world in one grab
HAISS
DIGGING BUCKETS
are weight-proportioned to sink their husky teeth in—and power-reeved (up to 7:1) to dig down for a heaping payload at every grab. Ask any crane operator!

GEORGE HAISS MANUFACTURING CO., INC., 139th St. & Canal Place, New York 51, N.Y.

Bucket agencies throughout the country. Write, wire for prices, delivery and catalogs.

HERE IS ONE OF THE DEPENDABLE

GRIFFIN GENERATORS



COMPLETE SELF-CONTAINED

Thoroughly dependable Power and Light anywhere wanted

A small capacity all-purpose job, protected from weather, dust. Simple, rugged. Gives 120 volts for lighting or 240 volts for power. EASILY MAINTAINED. Rolled by 1 man. On this single cylinder engine an all steel coupling running in a bath of oil prevents customary coupling troubles. Every small job requires one—large jobs can use several economically. Eliminate poles, long wiring, delays. Hardly a job of any magnitude completed without Griffin Generators. Call for further details.

MODEL 1A 3AH
SMALL COMPACT EASY TO HANDLE AC 3-WIRE

Steel Tread Wheels during the Rubber Shortage

"Engineered and built to give you the same dependable Long Life as all Griffin products."

MID-WEST
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548 Indiana Street • Hammond 1662
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633 N. Myrtle Ave. • Jacksonville 5-4516
JACKSONVILLE, 4, FLA.

Main Office: 881 EAST 141st STREET, NEW YORK 54, N. Y.

GRIFFIN EQUIPMENT
and Supply Corporation

(Continued from page 89)

nati, consultant on soils and asphaltic concrete pavement, C. O. Christy is technician on the job.

Under the active direction of Frank Mashuda, the supervising staff of the Frank Mashuda Co., prime contractor, Milwaukee, includes Stanley (Jack) Mashuda, superintendent; A. E. Delo, superintendent; F. R. Nickerson, engineer; and John Relihan, office manager. Asphaltic concrete pavement is laid under subcontract by Payne & Dolan, Chicago and Milwaukee, with Erve W. Habeck, superintendent in charge of the subcontractor's operations. Sand blanket and stabilized base for the paved areas are constructed under another subcontract by Gallagher, Kraemer & Watson, three associated contractors with headquarters at Madison, Wis., under the job supervision of two superintendents, Rudolph Kraemer and Ken Johnson. A subcontract for drainage construction is being carried out by the A. R. Coffeen Co., Decorah, Iowa, under the active direction of Mr. Coffeen. For this subcontractor, R. P. Kuehn, Green Bay, Wis., digs trench and lays pipe.

CONSTRUCTION EQUIPMENT
CAA AIRPORT, COVINGTON, KY.

Frank Mashuda Co., General Contractor, Milwaukee, Wis.

GRADING

Loading Equipment—Shovels—Bucyrus-Erie
1—48B Diesel combination shovel and dragline—2½ yd.
1—37B Diesel combination shovel and dragline—1¼ yd.
1—43B Diesel shovel—2½yd.

Rock Drilling Equipment—Ingersoll-Rand
1—Diesel compressor—500 cfm.
2—Diesel compressors—315 cfm.
4—Wagon drills (FM2)
8—Jackhamers (JA55)

Hauling Equipment
7—Diesel Euclids, bottom-dump—13-16 yd. (FDT)
3—Diesel Euclids, end-dump—15 ton (F)
5—Gas Sterlings, end-dump—7-8 yd. (HC140-DC26)
3—Atheys, side-dump—13-16 yd. (F32)

Tractors, Scrapers & Dozers
20—D8 Caterpillar diesel tractors
5—D8 " " "
1—D7 " " "
1—"L" Allis-Chalmers tractor
5—AK8 LeTourneau angledozers (for above tractors)
3—ADB LeTourneau bulldozers (for above tractors)
4—RU LeTourneau scrapers—23-30 yd.
1—C104 LaPlant-Choate scrapers—25-33 yd.
4—YR LeTourneau scrapers—12 yd.
2—J LeTourneau scrapers—12 yd.
2—J LeTourneau scrapers—20 yd.
7—TP Diesel Tournapulls and scrapers—12 yd.

Leveling and Rolling Equipment
3—No. 12 Caterpillar diesel tandem-drive motor patrols
2—No. 125 Adams power-control tractor-drawn graders
1—Buffalo-Springfield three-wheel roller—10 ton
3—TSR LaPlant-Choate three-drum sheepsfoot rollers

Supplemental Equipment
2—LeTourneau heavy-duty rooters
7—Pickup trucks—½ ton
2—Trucks—2½ ton
7—Trucks—1½ ton
1—Portable welder, gasoline engine—300 amp.
7—Light plants—1½-20 kw.

SUBCONTRACTORS

A. R. Coffeen Co., Decorah, Iowa

Drainage and Drainage Structures
1—14E CMC Mixer
2—Trucks—1½-ton
3—Pickup trucks—½ ton

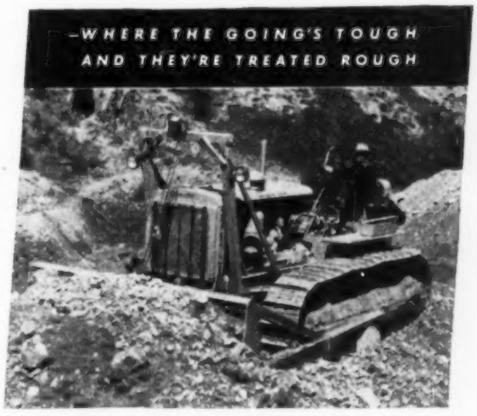
(Continued on page 96)

WOOLDRIDGE SCRAPERS

ARE AS RUGGED AS THE ROCKIES

TO WITHSTAND HEAVY WEAR AND TEAR

Wooldridge Scrapers are built from the ground up to insure longest trouble-free performance and lowest yardage costs. In their rugged construction they utilize a high carbon steel digging blade to withstand tougher and rougher usage. Dual steel plate apron is doubly reinforced by criss-cross welded structural steel diaphragms. Welded channels reinforce the one-piece dual steel box plate bottom of ejector-bowl against wear and tear while loading, traveling or dumping on rough or rocky ground. Fewer sheaves, less cable and no reverse bends cut down cable wear and "down-time" for repair to a minimum. Wooldridge Scrapers are built first—to last longer.



BOILING BOWL TERRA CLIPPER PRINCIPLE SCRAPERS

WOOLDRIDGE

MANUFACTURING COMPANY • SUNNYVALE, CALIFORNIA

SCRAPERS • POWER UNITS • BULLDOZERS • RIPPERS • TRAIL BUILDERS

ANOTHER LINK-BELT SPEEDER ON THE JOB FOR JOHN J. McHALE & SONS, INC. OF PAWTUCKET, R. I.

★ *BUY MORE BONDS THAN EVER BEFORE* ★

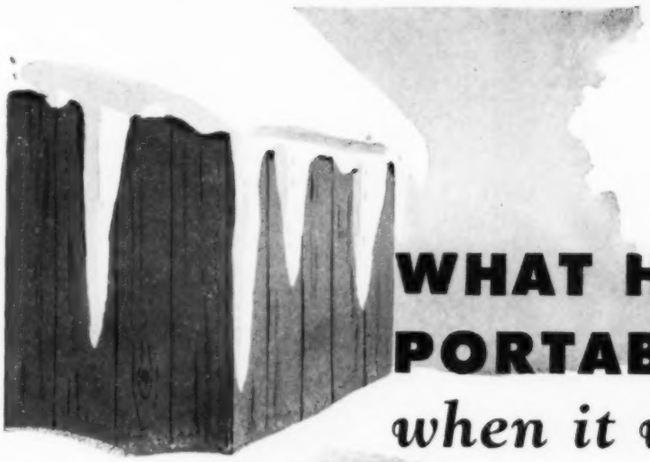
Link-Belt Speeder maintenance-free easy-to-handle machines are providing contractors all over the country with the kind of rugged, efficient service necessary to profitable operation. There are 25 different models of Link-Belt Speeder shovels, draglines and cranes—a type and size to fit every job.

9.93

LINK-BELT SPEEDER

Builders of the Most Complete Line of
SHOVELS-CRANES-DRAGLINES

LINK-BELT SPEEDER CORPORATION, 301 W. PERSHING ROAD, CHICAGO-9, ILL.
(A DIVISION OF LINK-BELT COMPANY)



WHAT HAPPENS to a PORTABLE COMPRESSOR *when it warms up from an Arctic-cold start?*

IF the compressor is a Gardner-Denver Water-Cooled Diesel Portable, here's what happens:

- The coolant of the starting engine circulates through the "Caterpillar Diesel" engine jackets and takes off the arctic chill.
- The "Diesel" is turned over slowly for a few minutes, with compression relieved, distributing oil over all bearing surfaces, including the pre-warmed cylinder walls, before it starts to fire.
- While the "Diesel" is slowly warmed up, with clutch disengaged, the pump circulates the rapidly warming coolant in the engine-compressor cooling circuit and warms the cylinder walls of the still idle compressor, for immediate lubrication when the clutch is engaged.

And that's why you'll find Gardner-Denver Portable Compressors preferred for winter jobs —and why the Gardner-Denver Portable delivers maximum air output. Burned-out bearings or scored cylinder walls and pistons due to cold weather starts are unknown to Gardner-Denver users.

You'll find that the Gardner-Denver Portable is equally efficient in tropical heat, too. For the same water-cooled construction assures a cooler running compressor, no matter what the heat.

For complete information on these "all-weather" portables, write Gardner-Denver Co., Quincy, Ill.

A Mobile Service...

FOR ANY GUN — PISTOL TO HOWITZER

"Keep 'em Firing"—no matter where they are. That's the slogan. Repair crews, with their mobile workshops, service all types of guns, from pistols to howitzers. Generating units, powered by gasoline engines, charge batteries and operate electric drills and other modern tools. This is typical of the multitude of vital jobs — both standard and special — for hundreds of thousands of rugged, dependable Briggs & Stratton engines "in the service."

TO those manufacturers now designing and experimenting with machines, tools, or equipment to be powered by portable gasoline engines, we offer the services and long experience of Briggs & Stratton's engineering and development staffs, without any expense or any obligation.

Their assistance and counsel may save you weeks of time and many headaches, and effect material economies and greater efficiency.

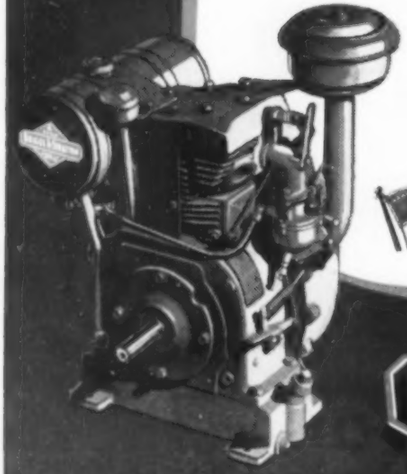
The reputation of Briggs & Stratton is world wide in the gasoline engine field. Thousands of dealers and millions of owners and users know that—

"It's powered right — when it's powered by Briggs & Stratton."

BRIGGS & STRATTON CORP.
MILWAUKEE 1, WIS., U. S. A.

•

BACK THE ATTACK WITH MORE WAR BONDS



4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES

(Continued from page 92)

R. P. Kuehn, Green Bay, Wis.

Sewers

1—Parsons No. 40 trenching machine
1—Parsons small trenching machine
2—Parsons backfillers
1—Northwest backhoe—1¼ yd.
1—Bay City backhoe and crane combination
2—Allis-Chalmers small bulldozers
2—Thor air compressors

Gallagher, Kraemer & Watson, Madison, Wis.

Sand Sub-Base and Stabilized Base

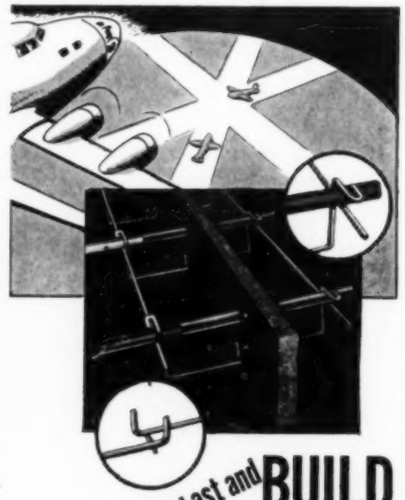
2—Universal crushing plants—capacity 150 tons per hour
1—10B Bucyrus-Erie shovel—⅜ yd.
1—75B Thew Lorain shovel—1¼ yd.
1—60B Thew Lorain shovel—1 yd.
70—Trucks—5 ton
1—Cedar Rapids stabilizing plant-capacity 100 tons per hour
1—Model 73 Pioneer stabilizing plant-capacity 120 tons per hour
2—Northwest cranes—1 yd.
1—Koehring shovel—1 yd.
1—Caterpillar RD8 tractor-bulldozer
4—Rubber-tire tractors
4—Bros wobble-wheel rollers
1—Huber 10-ton steel roller
2—No. 12 Caterpillar diesel tandem-drive motor patrols
4—Light plants—5 kw.

Payne and Dolan, Chicago, Ill.

Asphaltic Concrete Pavement

1—Mixing plant—capacity 90 tons per hour
1—Cummer pugmill mixer—2½-ton capacity
1—Nordberg vibratory screens, 4x12 ft.
1—Butler 60-ton storage bin, three separations
1—Special unit for adding limestone dust
1—Dryer 34 ft. long, 6 ft. diam.
1—Steam boiler—90 hp.
2—13-66 Caterpillar diesel-electric 90-hp. generator sets.
1—Asphalt storage tank—20,000 gal.
1—Fuel oil storage tank—12,000 gal.
1—Koehring crane—¾ yd.

(Continued on page 102)



Build Runways to Last and **BUILD FAST!**

with UNION "QWIK-LOCK" Expansion Joint Assemblies

● To speed up airplane runways construction—and assure an enduring job—use "Qwik-Lock" Expansion Joint Units. They simplify dowel installation... make it easy to lock and align dowels accurately. Designed for fool-proof, trouble-free functioning.

ARMY NAVY

UNION STEEL PRODUCTS COMPANY
439 Pine St., ALBION, Mich.

Write for Catalog of Construction Accessories . . . See Our Section in SWEET'S.

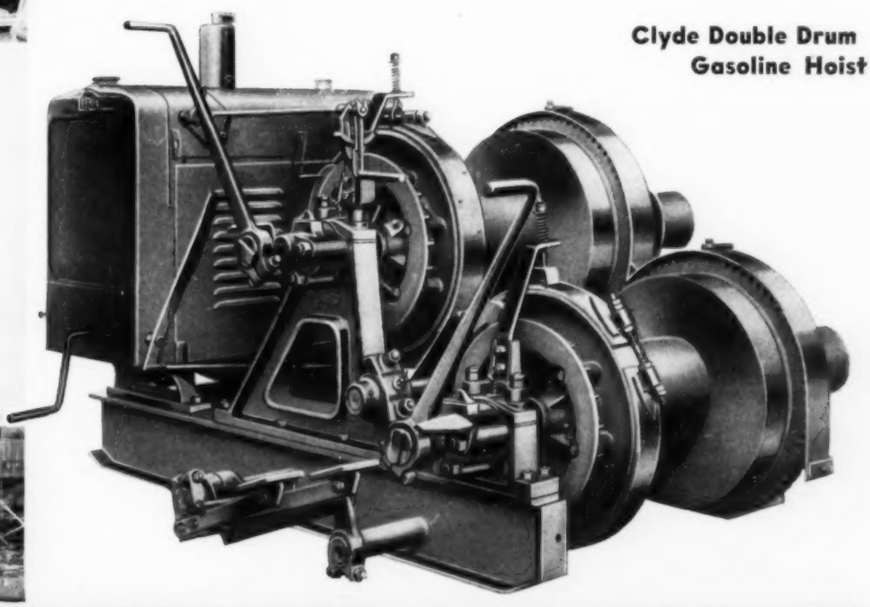
Clyde GAS HOISTS

FOR EVERY KIND OF WORK

For driving piles, handling a material elevator or operating a derrick . . . there is a Clyde Gasoline Hoist of the proper size and style to fit your needs.

Clyde equipment is designed and manufactured to give more efficient and economical performance . . . every part is carefully engineered for its particular load and duty . . . every machine has precision workmanship throughout.

The common-sense advantages of Clyde Gasoline Hoists will help with your post war construction problems. . . . Write for Bulletin K-4 now.



Clyde Double Drum Gasoline Hoist

CLYDE

CLYDE IRON WORKS, INC.
DULUTH, 1 MINNESOTA

5 reasons why

Ransome 34E SINGLE AND DUAL DRUM PAVERS GIVE YOU MORE PROFIT PER YARD OF CONCRETE

1. **EXCLUSIVE HYDRAULIC CONTROLS.** "Finger-tip" control of boom bucket gates, boom swing, water valves, discharge chute (also transfer chute on the Dual Drum) speeds, eases, and smooths operation.
2. **UNIQUE BOOM BUCKET GATES.** Hydraulic control of gates eliminates split batches . . . permits partial dumping of load at any point . . . allows simultaneous swinging and spreading.
3. **170 DEGREE BOOM SWING** . . . reaches ordinarily inaccessible places, like road intersections.
4. **QUICK-DISCHARGING SKIP** . . . elevates to 55 degrees in 6 to 7 seconds . . . shape eliminates spillage . . . self-cleaning. Special pivot bearings permit loading on uneven ground without damage.
5. **LONG CRAWLER** . . . 13 rollers on the Dual Drum, 10 on the Single Drum . . . wide crawler pads permit low ground pressure without sacrificing weight. Narrow overall width of crawlers allows working outside of forms or on 10 to 11 foot shoulders.

There are plenty of other reasons why your next paver should be a Ransome. Write for literature.

WR4-2

Subsidiary of
WORTHINGTON
Pump and Machinery Corporation

Power Plant Equipment • Turbines & Turbo-Generator Sets • Diesel & Gas Engines • Pumps & Compressors • Air Conditioning & Refrigerating Equipment Construction & Mining Machinery • Power Transmission Equipment • Locomotive Feedwater Heaters • Welding Positioning Equipment • Liquid Meters

ARMY NAVY

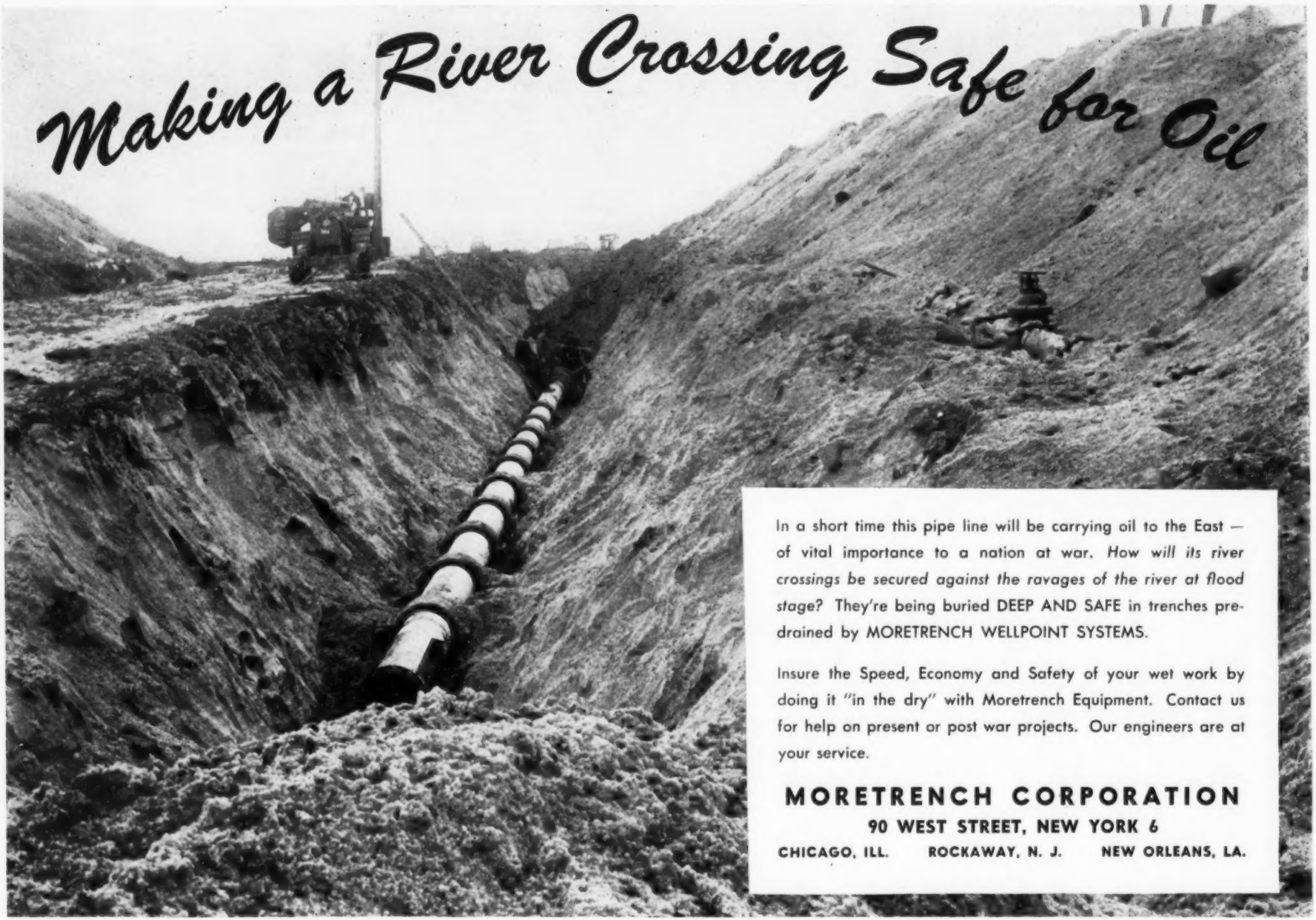
RANSOME REG. U.S. PAT. OFF. America's first & finest MIXER

Construction Division

Ransome MACHINERY COMPANY

DUNELLEN, NEW JERSEY

Making a River Crossing Safe for Oil



In a short time this pipe line will be carrying oil to the East — of vital importance to a nation at war. *How will its river crossings be secured against the ravages of the river at flood stage?* They're being buried DEEP AND SAFE in trenches pre-drained by MORETRENCH WELLPOINT SYSTEMS.

Insure the Speed, Economy and Safety of your wet work by doing it "in the dry" with Moretrench Equipment. Contact us for help on present or post war projects. Our engineers are at your service.

MORETRENCH CORPORATION

90 WEST STREET, NEW YORK 6

CHICAGO, ILL. ROCKAWAY, N. J. NEW ORLEANS, LA.

Ready Now!

NEW 1944 CATALOG and

WIRE ROPE BUYERS' GUIDE

Replaces ALL other catalogs

Changes in wire rope strengths, sizes, grades makes this new catalog a necessity to anyone specifying, using, and buying wire rope.

Information contained in the new 1944 Guide will save you delay in purchasing of wire rope, as well as help you conserve (through proper maintenance) your present wire rope.

Designed, Written for Wire Rope Users

Every wire rope user who *needs* a catalog for reference should have *this* one. It will help you on the job. This is no ordinary manufacturer's catalog. It is designed and written for the wire rope consumer.

Ask for your copy of Catalog G-15

No Charge, simply write your request on company letterhead and mail to Macwhyte Company, or any of our distributors and mill depots near you.

NO. 709

MACWHYTE COMPANY

Wire Rope Manufacturers

2941 Fourteenth Avenue, Kenosha, Wisconsin

Mill Depots: New York · Pittsburgh · Chicago · Fort Worth · Portland · Seattle · San Francisco

Distributors throughout the U. S. A.

MACWHYTE PREformed and Internally Lubricated Wire Rope
MONARCH WHYTE STRAND Wire Rope
MACWHYTE Special Traction Elevator Rope
MACWHYTE Braided Wire Rope Slings
MACWHYTE Aircraft Cables and Tie-Rods

NEW TYPE GUIDE... Many New Features!

Inside the covers of this 160 page BUYERS' GUIDE are all the facts and figures you'd expect to find about wire rope, PLUS many that will surprise you. And it's completely indexed with visual tabs for quick reference. Here are only a few of many features:

- ★ ***All information*** **in accordance with NEW wire rope simplification plan**
- ★ ***Tabular index*** **for split-second reference**
- ★ ***Handy pocket*** **and desk size (4½ x 6½)**
- ★ ***Special binding.*** **Pages lay flat when opened**
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- ★ ***Wire rope constructions***
- ★ ***Slings***
- ★ ***How to order*** **wire rope**
- ★ ***Working loads,*** **safety factors, sheave and drum tolerances, reeling and unreeling, how to seize ropes, etc.**
- ★ ***90 pages of practical data*** **on use and care of wire rope**
- ★ ***Discount tables***
- ★ ***Glossary*** **of wire rope terms in daily use**
- ★ ***16 sections,*** **each with quick tab index**
- ★ ***Complete index*** **to each section printed on each tab index, plus a complete index in back of book, plus a special feature, "YOUR INDEX."**

When you buy wire rope be sure to specify

MACWHYTE PREformed WIRE ROPE

DISTRIBUTORS EVERYWHERE RECOGNIZE THE *SUPERIORITY* OF STERLING

PUMPS · HOISTS · LIGHT PLANTS

Consult Your
STERLING DISTRIBUTOR
An "ARMY" OF SERVICE ENGINEERS at YOUR Command!
STERLING PUMPS DELIVER THE GOODS—THEY ARE EASY TO OPERATE AND EFFICIENT
Charles H. Green

Contractors Proclaim the Soundness of This Judgment

Yes, Contractors all over the world back up the judgment of men like Mr. J. S. Gilman of Wm. H. Ziegler Co., Inc., Mr. Charles H. Green of Woodward, Wight & Co., Ltd., Mr. C. A. Channon of Great Lakes Supply Corp., Mr. A. Rudich of The General Supply Co., S. A., and over a hundred other distributors who have placed more than twenty thousand Sterling Units on all types of construction jobs.

★ SIMPLE
★ DEPENDABLE
★ RUGGED

You, too, will agree with these men. You will find Sterling's Simple, Dependable and Rugged design your "Rock of Gibraltar" on any job . . . no matter how difficult.

There's A STERLING DISTRIBUTOR NEAR YOU!

Be sure to call your Sterling Distributor . . . he will be glad to help you. If you do not know his name, we'll put him in touch with you.

They Like STERLING
PUMPS · HOISTS · LIGHT PLANTS
In Mexico Too!
THE GENERAL SUPPLY CO. S.A.
OUR CUSTOMERS ARE CONVINCED THAT STERLING MEANS QUALITY
Sterling
MACHINERY CORPORATION

Write for Catalog

Don't delay . . . send for literature on Sterling Pumps, Hoists and Light Plants at once. We've stepped up production and can make prompt shipment on most orders in spite of heavy wartime demands.

We're Proud of This Association

This is one way of our saying that we are one of the oldest Allied Members of the A. E. D. The Sterling Shield and the A. E. D. Circle is a team hard to beat.

Sterling

MACHINERY CORPORATION

405-13 SOUTHWEST BLVD.
KANSAS CITY 10, MISSOURI

This is a weapon of war...

Epidemics of flu and other diseases are enemies holding up our march to victory.

One of the effective weapons being used to combat such foes, is Dixie's Portable Water Carrier, with its health-protecting paper cup service.

★ **HELPS REDUCE SICK-ABSENTEEISM**

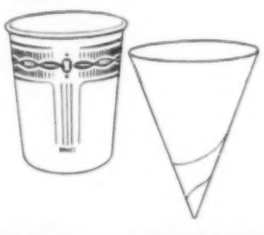
Many an employer on a construction project has discovered that regular use of this modern method of watering men at work, helps keep down sick-absenteeism.

Throughout industrial America, Dixie and Vortex Cups, which are used but once, then discarded, help prevent the spread of illness.

Yet so great is the need of them to protect both our armed forces and essential workers, that demand far exceeds supply. We are doing our best to catch up.

Dixie and Vortex paper cups are made at Easton, Pa., Chicago, Ill., Darlington, S.C. and Toronto, Canada.

We suggest you keep on asking for Dixie Cups even though they are hard to get. We're doing our best to catch up. The war needs come first; then our old and regular customers. So keep on asking —maybe next time your Dixies will be available.



DIXIE CUPS

DRINKING CUPS AND FOOD CONTAINERS

(Continued from page 96)

Paving Equipment

2—Adnun bituminous pavers
1—Barber-Greene bituminous paver
2—Buffalo-Springfield 8-10-ton tandem rollers
1—Buffalo-Springfield 6-ton tandem roller
1—Power sweeper
1—Buckeye chip spreader
2—Trucks—7½ ton
3—Trucks—5 ton

★ ★ ★

Detroit Tank Arsenal

(Continued from page 82)

12 to 40 in. to establish a grade for the succeeding course of bank-run gravel, 22 in. deep.

For the latter course, bank gravel containing sufficient clay for stability was placed in four layers to make up the total depth of 22 in. On top of the bank-run gravel, a 10-in. course of crushed and stabilized gravel was constructed in two 5-in. layers, with limestone dust mixed and wet-bound into the top layer. This course provided the base for the 6-in. asphaltic concrete pavement, consisting of two 1½-in. layers of binder mixture (1-in. maximum size aggregate) and two 1½-in. layers of wearing course mixture (½-in. aggregate). Side slopes and transverse grades of the embankment and pavement are shown on the cross-section drawing. Pavement width increased from 30 ft. on tangent to as much as 60 ft. on curves, all of which are superelevated.

Embankment Construction

Successive courses of the embankment were stabilized and consolidated in accordance with the characteristics of the various materials and their proximity to the pavement, the greatest stability and density being required in the layer immediately under the asphaltic concrete. Construction of the embankment involved about 80,000 cu.yd. of imported material, truck-hauled to the job.

Methods employed in compacting the various courses included tractor-scraper and tractor-bulldozer travel, sheepsfoot and pneumatic-tired rollers drawn by crawler tractors, and a steel three-wheel roller, the different types of equipment being selectively applied to fit the characteristics of the material. To obtain required compaction, moisture was carefully controlled in completing the bottom lift of bank-run sand and in constructing the 22-in. bank-run gravel course and the 10-in. stabilized gravel base, wet-

(Continued on page 106)

Velvetouch BIMETALLIC FRICTION MATERIAL

VELVETOUCH is available in a wide variety of constructions for every industrial application.

A scientific combination of POWDERED METALS for brakes and clutches

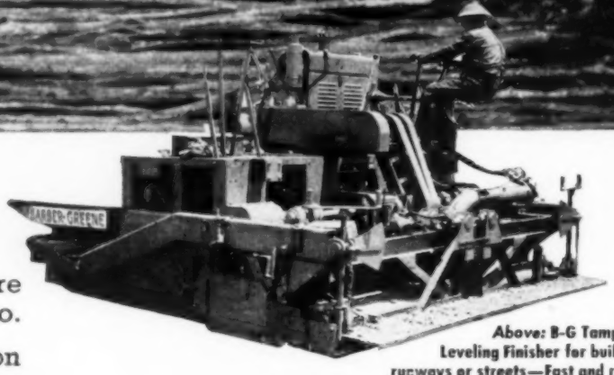
THE S. K. WELLMAN CO.
1374 East 51st St., Cleveland, Ohio

Pioneers in putting Powder Metallurgy to work for Industry . . . . . .

O-K to LAND

"O.K. to land" says the control tower and this PAA Strato-Clipper glides in to a smooth landing. The fully-equipped terminal and level paved runways of this Latin American airport were mere engineer blueprints not long ago.

This is but one of scores of airports on the globe-girdling routes of Pan American Airways built from scratch or vastly enlarged as the demands of war stepped up the tempo of air transport. They were hacked out of jungle, built on filled-in swamp and sandy ocean isles, using modern construction equipment. Barber-Greene Finishers substituted level runways for corduroy roads, for wind-blown sand, for feverish swamp. In YOUR planning, get complete Barber-Greene information first. 44-2



Above: B-G Tamping-Leveling Finisher for building runways or streets—Fast and right.

BARBER-GREENE

AURORA, ILL.

OLIVER rivets bolts & nuts

dependable fasteners for steel construction

The smooth, true shanks, accurate heads and uniform material of Oliver rivets—together with the complete range of sizes available—makes these fasteners the first choice of structural men everywhere.

Likewise, Oliver Fitting-up Bolts, Timber Drive Spikes, Dardelet Bolts and other fasteners are universally favored where uniformity and dependability are desired.

All Oliver products are available in a complete range of sizes and heads, and many come in various alloys, materials, heat treatments and protective coatings.

For complete satisfaction, always specify Oliver bolts, nuts, rivets and Timber Drive Spikes.

OLIVER
IRON & STEEL CORPORATION
5. TENTH AND MURIEL STS.
PITTSBURGH, PA.

(Continued from page 102)

bound with limestone dust in the top 5 in.

For the 10-in. base course immediately under the pavement, the constructors used a stabilized gravel of which 100 percent passed a 2-in. screen and 6 percent passed a 200-mesh sieve. Grading on fines was much closer than allowed by the specified requirements shown in an accompanying table. The material ran about 35 percent crushed gravel. Samples compacted by rodding gave 135-lb. density.

Both layers of the 10-in. stabilized gravel course were compacted at optimum moisture content. The first 5-in. layer was packed by sheepsfoot roller and was smooth-rolled by pneumatic-tired roller or 15-yd. scraper, whichever was available. For the second 5-in. layer, 30 lb. per sq.yd. of limestone dust was added and mixed in by Seaman Pulvi-Mixer (rotary tiller) or by orchard cultivator, increasing the total fines to 12 percent, before the material was compacted by sheepsfoot roller. The dust came to the job hot from the mills, and water ordinarily had to be added by pressure distributor for wet-binding the mix.

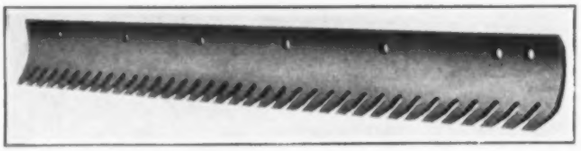
After the final layer of stabilized gravel.

(Continued on page 110)

SHUNK
GRADER BLADES

★

Saw Tooth Scarifier Blades



● At the battle fronts and on all types of war projects at home — wherever Graders, Patrols, Bulldozers, Scrapers of all types are used you will find Shunk Grader Blades can "take it" under toughest operating conditions.

SHUNK Blades offer specific advantages—in strength—interchangeability—longer life. They are made of special refined high carbon high manganese plow steel, rolled to our own analysis in our own rolls at the mill—forged at the edges and ends to provide greater strength—accurately machined and shaped to fit equipment for which intended—scientifically manufactured to withstand severe wear.

Reasonably *prompt shipment* is assured of various types and styles from stock carried at factory for your convenience. When ordering Blades the following information should be specified—name, model number, length and thickness. To make certain punchings are correct advise total number of holes in blade.

POST WAR HIGHWAY

construction and maintenance work will require great quantities of earthmoving equipment — this is certain because plans for new construction of roads and highways have already reached a total of $800,000,000. SHUNK Grader Blades and a full line of modern equipment will be ready to do its part in meeting the demands of the Post-War job. Remember the SHUNK Line will again serve you.

For specific information on both Grader Blades and Saw Tooth Scarifier Blades — write for full descriptive bulletins.

SHUNK MFG. COMPANY

Established in 1854

Bucyrus, Ohio, U.S.A.

Until the Shooting Ends....

. . . THE BYERS CRANE YOU NEED IS BEING SHIPPED TO AN OUTFIT THAT NEEDS IT MORE THAN YOU DO.

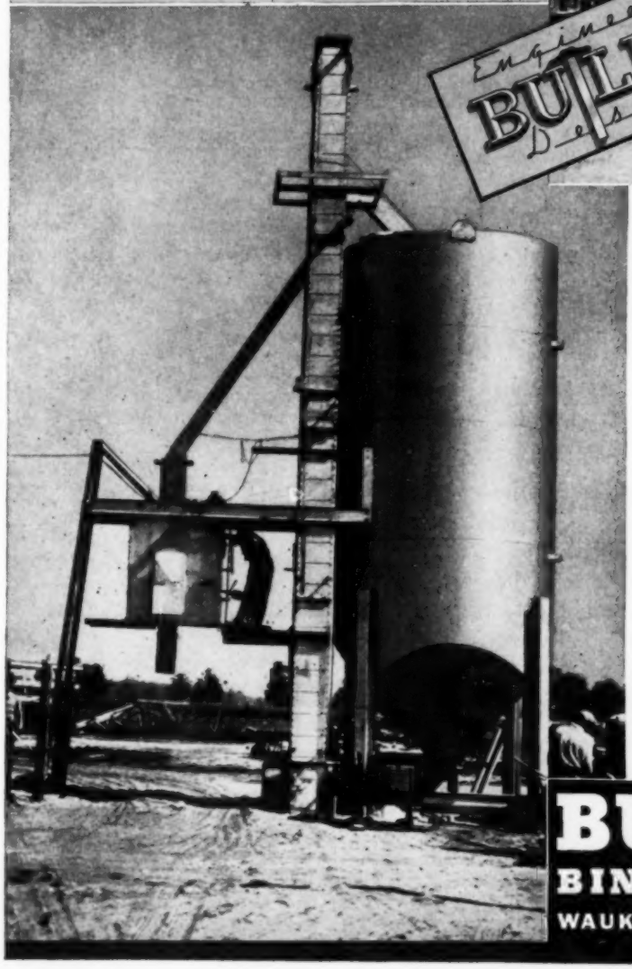
In the meantime, owners of current and older models of Byers shovels and cranes may depend on Byers Parts Service to help them keep present equipment working steadily and satisfactorily.

BYERS CRANES AND SHOVELS
RAVENNA, OHIO
DISTRIBUTORS THROUGHOUT THE WORLD

Yesterday—
Butler Designed for Today,—
TODAY,—*Butler Designs*
FOR TOMORROW

Prepare Now...
FOR HUGE POST-WAR AIRPORT AND HIGHWAY EXPANSION
With Butler Equipment

Engineered BUTLER Design

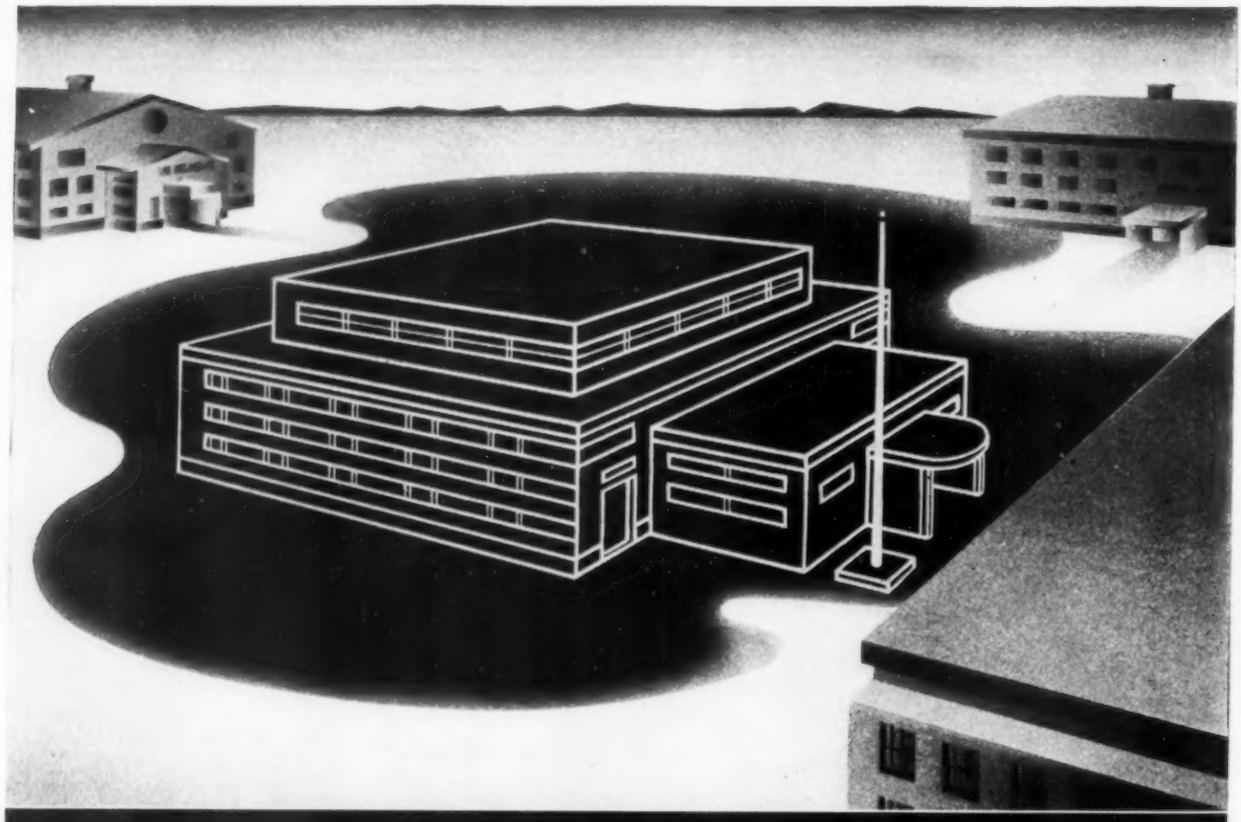


Butler bulk cement plants and batching plants built five, ten, and even twelve years ago are still working today in vital airport and highway construction — and they are working at speeds few men dreamed of a few years ago.

Then, a single 27E paver was sufficient for most jobs. Contrast this with jobs today using two 34E dual drum pavers — and sturdy, reliable Butler equipment still keeps up with the gruelling pace.

Using Butler equipment, you can meet today's problems with yesterday's plants. Be ready for postwar contracts by checking into tomorrow's already on Butler's drawing boards.

BUTLER BIN COMPANY
WAUKESHA, WISCONSIN



ANOTHER OBJECTIVE IN A WINTER CAMPAIGN

When new hospital facilities are needed today—they're needed fast. And winter weather is no excuse for delays. One way to speed completion is to use Atlas High-Early cement.

IT'S good building strategy to use Atlas High-Early to overcome winter delays. With it you get serviceable concrete often in one-third the usual time or less.

Protection and heating time is cut. You can release salamanders and tarpaulins more quickly. Forms can be stripped earlier and reused on other parts of the job. Thus you not only save time but also save on salamanders, tarpaulins, fuel and forms.

Atlas High-Early helps you keep concreting work to schedule—sometimes ahead of it—ready for the other work needed to complete the job.

Before you start your next winter job, ask for further information on Atlas High-Early and for experience records on other jobs. Write to Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

CHECK ON ATLAS HIGH-EARLY
for Wartime Construction

Because Atlas High-Early cement gains strength rapidly — produces serviceable concrete in one-third the usual time or less on some jobs, it—

1. ***Permits earlier use*** of concrete, and thus gives owner earlier occupancy.
2. ***Saves manpower*** when such conservation is needed most—releases men for new jobs more quickly.
3. ***Conserves lumber.*** Forms may be stripped sooner—sometimes in 24 hours instead of from 3 to 5 days—and re-used. Hence fewer sets of forms may be needed, saving time, labor and lumber.
4. ***Shortens time required for protection and curing*** as much as 70%. This saves fuel and releases tarpaulins and salamanders for other work more quickly.
5. ***Reduces overhead*** by saving time, manpower and equipment.

CM-H-62

OFFICES: *New York, Chicago, Albany, Boston, Philadelphia, Pittsburgh, Minneapolis, Duluth, Cleveland, St. Louis, Kansas City, Des Moines, Birmingham, Waco.*

SAVE TIME IN WARTIME WITH

Atlas High-Early Cement

A UNIVERSAL ATLAS PRODUCT

U. S. Navy Official Photo

Finishers Follow FAST when VACUUM is used

Right on the heels of the vacuum gang come the finishers—for as soon as the vacuum mats are removed, they can go to work.

For a principle of the vacuum process is not only suction, to remove excess water—but also Pressure—from the atmosphere—¾ of a ton of it per square foot—to compact the concrete and close up any remaining voids.

Hence the newly poured surface is firm and solid and permits the finishing gang to walk right on and WORK.

And—the finishers say they like to handle vacuumed concrete. "There's plenty of fat" to trowel, even with economical mixes. No dust coat or "drier" is needed on Vacuum poured slabs.

And—SUCH concrete—

A mix designed for 2500 lb. compressive strength in 28 days, develops 4000 lb. or more.

Actually taken from a batch untreated by vacuum, a sample shows 2500 to 2800 in 28 days. Another sample from the SAME batch—but treated by Vacuum—actually develops 4000 to 4500 lb. in the same period of time.

A result of this is Quicker construction. Forms may be stripped earlier, and all the work progresses faster.

Winter concreting is safer—there is less danger of freezing.

VACUUM has MORE ADVANTAGES

Larger Daily Pours.
Overall Time of Job Reduced.
Reduces Shrinkage.
Increased Bond Strength.
Winter Protection Costs Reduced.
And other advantages which are fully covered in Data. Write Dept. C. M.

Use Coupon NOW ➡

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Get the complete story. We can't tell it all here—
WRITE FOR THE ENGINEERING AND CONSTRUCTION DATA.

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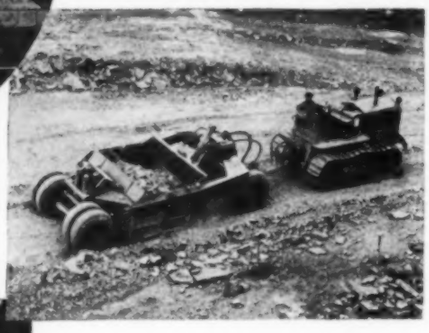
GOODALL means *fast going* on road construction!

Four GOODALL items, ready to do *more* than their share toward keeping your job moving ahead of schedule. Each has a reputation for staying on the job *longer* . . . no early, unexpected failures to cause delays or shutdowns.

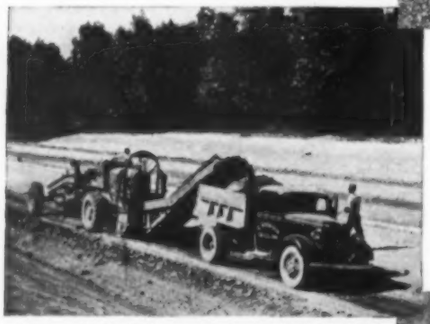
"ROADBUILDERS" HIGH PRESSURE WATER HOSE

Built to contribute to the full-time operation of mixers, pavers and other roadbuilding equipment. Tough black cover, on rugged GOODALL quality carcass. Light weight, flexible, easy to handle. Sizes 1" to 2", inclusive.



HYDRAULIC HOSE. Spec. S-90

For high pressure oil or water hydraulic equipment having power take-off. Wire braided construction. Sizes ½" to 1½", I.D.



"76" GRADER BELTING

Rugged, long-wearing, thoroughly reliable. Made of 32-oz. duck, with 16 to 19 lb. friction. Tensile strength of cover, 1,700 to 2,200 lbs. 18" to 48" widths, 4 ply.

"SUBWAY" Heavy Duty AIR HOSE

All-Synplastic. A tough, durable hose of wrapped duck construction, designed to withstand the roughest, toughest service with complete safety and reliability. Sizes ½" to 1¼", inclusive.

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Contact our nearest branch or main office for prices and delivery details relating to these and other Goodall hose and belting, boots and clothing.

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WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

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Branches and Distributors from Coast to Coast.

THE GOODALL-WHITEHEAD COMPANIES

Factory—Trenton, N. J. (Est. 1870) 74 Years of "Know How"—Our Most Valuable Commodity.

(*Continued from page* 106)

wet-bound with limestone dust, had been finished to grade and transverse profile, the surface was given a prime coat of MC-1 cutback asphalt applied at a rate of about 0.3 gal. per sq.yd.

Asphalt cement actually used in the mixes was about 5 percent for binder and 6.2 percent for wearing course. This asphalt, of course, met the specified 85-95 penetration requirement. The gravel aggregate was 100 percent crushed and was harder than specified, showing a loss of 30 percent or less by Los Angeles abrasion test, as compared with a maximum of 40 percent permitted.

Paving of the test track called for slightly more than 30,000 sq.yd. (9,000 tons) of asphaltic concrete. A portable Warren Bros. asphalt plant set up on permanent foundations at a yard of the Cooke Contracting Co. turned out the hot mixes in a 2,500-lb. pugmill, with 1-min. wet mixing, at a rate of 50 tons an hour. Temperatures of mixed materials in the trucks before leaving the plant were 310-325 deg.F. for binder course and 320-340 deg.F. for wearing course.

For better construction control, and in order to obtain maximum density, both

(*Continued on page* 114)

Try them on your toughest problems!

For years these books have provided structural engineers with the facts they need on every problem concerned with the design and construction of civil engineering structures. They furnish genuinely professional information drawn from records of actual practice and written by a large staff of specialists.

HOOL AND KINNE'S

STRUCTURAL ENGINEERS'

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With many newly revised sections containing up-to-the-minute standards and practice

The most complete compilation of structural engineering data ever published. Six volumes cover the how and why of foundation and substructure design and construction; general theory of structural members, their detailed design and connection with other members; explain the principles of statics, reactions, moments and shears in beams and trusses, influence lines, methods of computing stresses; give details of design and construction of steel, timber, and concrete structures of all types. 6 volumes, 3575 pages, fully illustrated.

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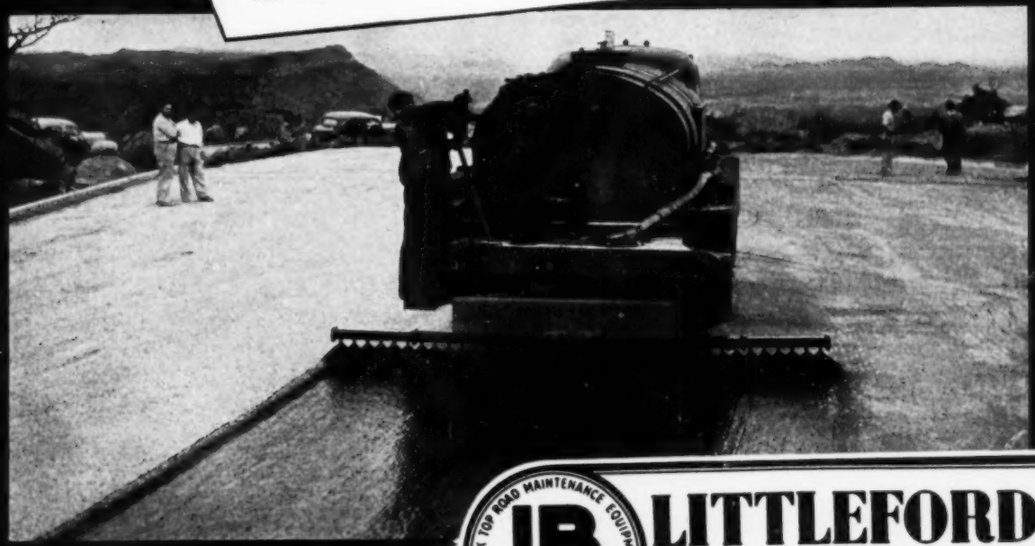
SINGLE VALVE CONTROL

Top Photo: "Spray Master" with Vaporizing Torch Type Burners and Rear Engine Mounted.

Lower Photo: "Spray Master" with Low Pressure Atomizing Burner and Front Engine Mounted.

One valve Starts and Stops the spray instantly! Here is one reason why the Littleford "Spray Master" Pressure Distributors will definitely speed up the Construction and Maintenance of our vital post war highways, roads, streets and airports. This Single Valve Control, the exclusive "Spray Master" feature eliminates the maze of gadgets, controls and valves found on units of this type. Littleford again leads the way to modern, efficient Black Top Construction and Maintenance Equipment. When planning for the future, consider equipment designed and engineered for our much needed highway system in the near future.



BLACK TOP ROAD MAINTENANCE EQUIPMENT
LB
SINCE · 1900

LITTLEFORD

LITTLEFORD BROS., INC.
465 E. Pearl St., Cincinnati, Ohio

When we leave the WARPATH-

Tomorrow when Victory is ours and we leave the warpath you will be needing new shovels, cranes and draglines for the big jobs that are now being held in abeyance. When that time comes LIMA will be ready to give your excavator and crane requirements undivided attention.

Faster, safer and more efficient LIMA Shovels, Cranes and Draglines will be available through the use of new material, new methods of manufacture and experiences gained from war time service. The many new advantages to be offered by LIMA will help you make more profit through greater output on the big jobs coming up.

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A TYPE and SIZE for EVERY JOB

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Is it *strength?*
Is it *velocity of detonation (shattering effect)?*
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Is it *water resistance?*
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Is it *good fumes for close underground work?*
Is it *convenience?*

There's Profit in the Right Explosive

Among the over 120 kinds and grades of Atlas explosives, many in different sizes and types of packing—in all, several hundred choices—you will find the right grade for *your* purpose.

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AMMONIA DYNAMITES

High Density

EXTRAS
Str. 15%–60%
Vel. 7300–12,000
Den. 105

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Str. 20%–70%
Vel. 9000–19,000
Den. 115

Stumping Expl.
Str. 15%–50%
Vel. 7800
Den. 103–117

Low Density

AMODYNS
Str. 65%
Vel. 5800–10,000
Den. 118–173

Stumping Expl.
Str. 30%–65%
Vel. 7400–9000
Den. 133–165

APCODYNS
Str. 65%
Vel. 7000–9000
Den. 128–180

NITROGLYCERINE DYNAMITES

Free Flowing

FLO-DYNS
Str. 10%–65%
Vel. 4600–5400
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FARMEX Ditch.
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Den. 103–108

Permissible

COALITES
Str. 55%–60%
Vel. 6000–10,000
Den. 133–244

APCOLS
Str. 60%
Vel. 4500–7000
Den. 133–178

Nitroglycerine Dyn.
Str. 20%–60%
Vel. 8800–19,000
Den. 105

SEMI-GELATINS

Permissible

GEL-COALITES
Str. 35%–60%
Vel. 8200–16,400
Den. 97–107

Permissible

GEL-COALITES
Str. 55%–60%
Vel. 5900–12,000
Den. 120

Ammonia

GELODYNS
Str. 65%
Vel. 10,000–11,000
Den. 110–128

GELATINS

Ammonia

GIANT
Str. 30%–90%
Vel. 7000–20,000
Den. 85–100

PETROGEL
Str. 60%
Vel. 18,000
Large Cartridges

Nitroglycerine

ATLAS
Str. 20%–100%
Vel. 6500–20,000
Den. 85–100

Blasting Gel.
Str. 100%
Vel. 20,000
Large Cartridges

Oil Well Expl.
Str. 80%–100%
Vel. 20,000
Large Cartridges

PETROGEL H.V.
Str. 60%–100%
Vel. 18,000–20,000
Large Cartridges

Str. % Strength
Vel. Velocity of detonation, feet per second, in the open 1¼" x 8"
Den. Minimum number 1¼"x8" cartridges per 50-lb. case.

Explosives are tools! It is important to pick the right tool for your job—and then handle it properly.

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY
WILMINGTON 99, DELAWARE
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Industrial Explosives • Industrial Finishes • Coated Fabrics • Acids
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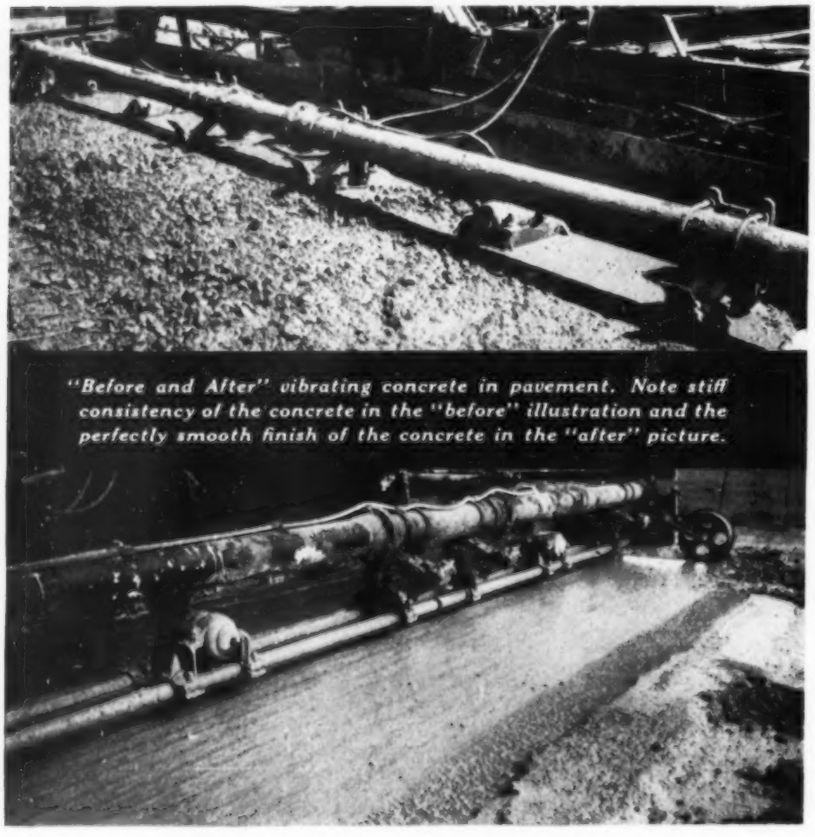
The JACKSON Vibratory Paving Tube Geared to Postwar Highway Jobs

The proposed postwar program of national highway and airport construction forecasts unprecedented large scale concrete construction jobs. . . The JACKSON Vibratory Paving Tube, specified by many highway departments before the war and used extensively on airfield paving war projects, is well qualified to meet the requirements of speed and economy that will be required of postwar paving equipment in producing durable concrete.

The JACKSON Vibratory Paving Tube accomplishes complete puddling and consolidation of compaction of the stiffest and harshest mixes of pavement concrete, assuring an excellent finish. Engineers and contractors find that economical mix designs can be more quickly and easily placed with the JACKSON Vibratory Paving Tube than with ordinary methods. . . Excellent results can be obtained with the JACKSON Vibratory Paving Tube when mounted on any standard modern finishing machine. . . Write today for full information.



"Before and After" vibrating concrete in pavement. Note stiff consistency of the concrete in the "before" illustration and the perfectly smooth finish of the concrete in the "after" picture.

Manufactured by Electric Tamper & Equipment Co.

..FOR..

JACKSON VIBRATORS, INC.

LUDINGTON MICHIGAN

(Continued from page 110)

binder mixture and wearing course mixture were put down in 1½-in. layers. Dispensing with forms, the contractor used two Adnun self-propelled black-top pavers to spread the hot mixture for each layer in 10-ft. lanes.

DETROIT TANK ARSENAL TEST TRACK

Gradation Requirements

Screen	Percent passing
Stabilized Gravel Base	
2-in.	100
1½-in	70–100
¾-in.	50–80
No. 4	30–60
No. 40	10–30
No. 200 (1)	5–15
Asphaltic Concrete Binder Course	
1½-in.	100
1-in. (2)	84–100
½-in.	67–82
No. 4	48–65
No. 10	37–54
No. 40 (3)	21–32
No. 80 (4)	12–21
No. 200	4–9
Bitumen (percent)	4–6
Asphaltic Concrete Wearing Course	
¾-in.	100
½-in. (5)	91–100
No. 4	67–80
No. 10	54–67
No. 40 (3)	31–41
No. 80 (4)	19–26
No. 200	5–9
Bitumen (percent)	5.5–7.5

(1) Fines passing No. 200 actually ran about 6 percent.
(2) Not more than 6 percent was retained on 1-in. screen.
(3) Material passing No. 40 actually ran 30-31 percent.
(4) Material passing No. 80 actually ran 12-12½ percent, which was low for wearing course.
(5) For wearing course, 100 percent passed ½-in. screen.

Batch Proportions, Binder Course	
Crushed gravel	1,200 lb.
Sand	1,050 lb.
Limestone dust	125 lb.
Asphalt cement	125 lb.
Batch Proportions, Wearing Course	
Crushed gravel	1,000 lb.
Sand	1,165 lb.
Limestone dust	185 lb.
Asphalt cement	150 lb.

Chrysler-built M-4 medium tanks weighing 30-32 tons use the track for running tests at five speeds ranging from creeper gear to a high of about 30 m.p.h. Total travel distance by each tank is 50 mi. Under this wear, the 6-in. asphaltic concrete pavement on built-up stabilized foundation stands up well and requires little maintenance.

Total length of the figure-eight track is 7,720 ft. Around the outside loop, the distance is 5,800 ft. Original plans called for curves of 335-ft. radius at the four corners of the outer loop, and two turns were built to this radius in the first half of the track to be completed. These curves are widened to 45 ft. and are superelevated.

Because long curves caused unnecessary wear of tank brake bands, which are

(Continued on page 118)

where will I stand

IN THE POST WAR PICTURE?

Will I be at the head of the parade or will competition have the edge?

For many it depends greatly on how fast the "change-over" to the manufacture of peacetime goods can be made and how quickly new plant construction or modernization can be started and completed.

If your plans call for any new construction or plant conversion or modernization, get your plans and specifications ready now. Planning will be a bottle-neck if it is put off too long—the bottle-neck for peacetime prosperity for industries as well as individuals. Call in your architect, engineers and general contractor. This is blueprint time!

A general contractor who is an AGC member is reliable, and competent, and can give valuable assistance to your architect and engineers as well as construct your project efficiently and with economy.

THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC.

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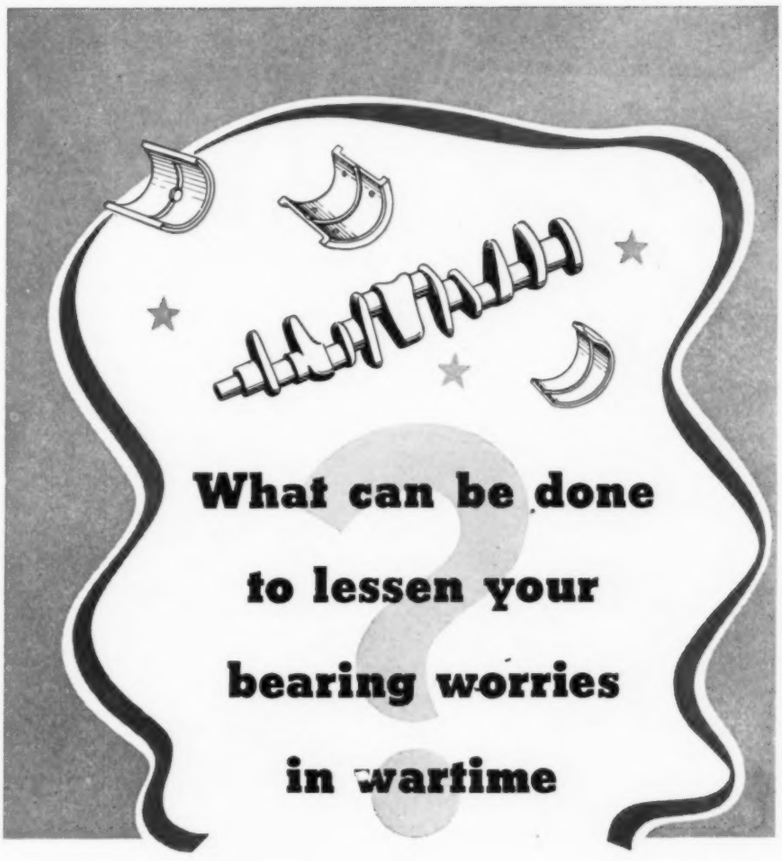
Serving with the Seabees ★

The Seabees—those tough and able men who carve airfields out of tropical islands, set up bridgeheads while enemy bombers drone overhead, and move equipment across rivers and canyons amid whining bullets—are among the foremost users of Bethlehem Wire Rope.

The Seabees are using Bethlehem Wire Rope on power shovels, cranes, hoists, dredges and on the many other pieces of equipment used in military construction. Hundreds of tons, millions of feet, of Bethlehem Wire Rope are going into ships' rigging, truck-winch cables, towing hawsers, Navy-yard dredges, mines, oil fields and war-plants. We are doing our best to produce more rope, better rope, faster.

★ ★ BETHLEHEM STEEL ★ ★ **BETHLEHEM WIRE ROPE**



● THERE ARE many reasons why you may find bearing problems increasing today. Many of the metals which gave prewar bearings long life are needed for the war effort. Many types of bearings now available are not suitable for heavy-duty service. Even under prewar operating conditions these bearings would tend to wear out faster. But today, loads are heavier. Maintenance is more difficult because of the manpower shortage. Longer hours of operation increase the load on bearings. Even prewar bearings are hard put to stand the gaff.

That makes the problem two-sided—how to make wartime bearings last longer, and how to keep prewar bearings on the job.

There is no simple solution. We show at the right a check list of steps that can be taken. While these do not offer new ideas in maintenance practice, they do have *new significance* today. A Standard Automotive Engineer can help you use this list to tighten up your shop practice to secure the utmost protection of your equipment.

A wartime oil for these wartime problems. Two of the most important items on the check list are—"Keep crankcase cleaner," and "Use the right grade and kind of motor oil." Hundreds of fleet operators have been turning to Stanolube H.D. Motor Oil in this emergency.

Stanolube H.D. has been available to the U.S. and fleet operators only since about the start of the war. Although civilian use of this is restricted, it is available to fleet operators because of the vital part they have in the war effort, and because of the severity of the service.

Stanolube H.D. is a detergent oil, but in addition, it is "heat-proofed" to retard oxidation. Therefore, it serves in *two* ways to prevent harmful deposits that cause bearings to wear out more quickly:
1. Because of its detergent properties, it holds fine dust and carbon particles in suspension so that they are removed when oil is drained. 2. The "heat-proofing"—inhibiting against oxidation—practically eliminates trouble resulting from oil oxidation products, another form of deposits particularly troublesome today.

More help on wartime bearing problems. Standard Automotive Engineers are working right now with other fleet operators on bearing problems just like yours. They will be glad to give you the benefit of their experience. You can reach one of these Engineers by calling the nearest Standard Oil Company (Indiana) office, or by writing 910 S. Michigan Avenue, Chicago 5, Ill. In Nebraska, address Standard Oil Company of Nebraska at Omaha 2.

A check list of suggestions for bearing maintenance

1. Use greater care in selecting bearing types and bearing materials best suited to your equipment.

2. Make sure that wartime shop practice gives extra care to proper fitting of bearings as recommended by manufacturers.

3. Check bearings more frequently for wear—an oil leak detector is one easy way.

4. Reduce detonation by:

a. Installing heavier cylinder head gaskets, or two regular gaskets

b. Retarding spark

5. Maintain proper engine temperatures:

a. Low enough to prevent damage to oil and bearings—especially important with wartime bearings—by:
(a) Increasing water circulation
(b) Keeping cooling system cleaner
(c) Keeping crankcase full

b. High enough to avoid dilution and water condensation—by:
(a) Covering radiator
(b) Reducing air circulation
(c) Insulating crankcase

6. Keep crankcase cleaner by:

a. More frequent oil changes

b. More frequent filter changes

c. Proper maintenance of crankcase ventilating system

d. Proper maintenance of air cleaner

7. Use the right grade and kind of motor oil

a. Grade: light enough for adequate cooling; heavy enough for protection

b. Kind: detergent to prevent deposits; stabilized to prevent oxidation and varnish formation.

Oil is Ammunition . . . Use it Wisely

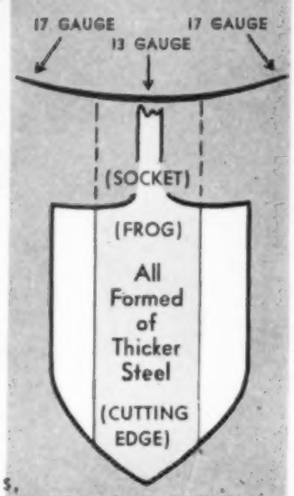
STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ **FLEET CONSERVATION SERVICE**

a tire is thicker in the tread,
a gun is thicker in the breech,
this shovel is 60% thicker up the
center than at the sides

Strengthens *ALL* Points
of Wear and Strain *

NOTE THIS
CROSS SECTION:



RAZOR-BACK

Correct design gives 13 gauge strength with only 15 gauge average weight, permits deep hang, better working balance.

THE UNION FORK & HOE COMPANY
653 Hocking Street Columbus 15, Ohio

ALSO STONE, BALLAST, INDUSTRIAL FORKS, ASPHALT AND ROAD RAKES — DISTRIBUTORS EVERYWHERE

WELLMAN WILLIAMS TYPE BUCKETS

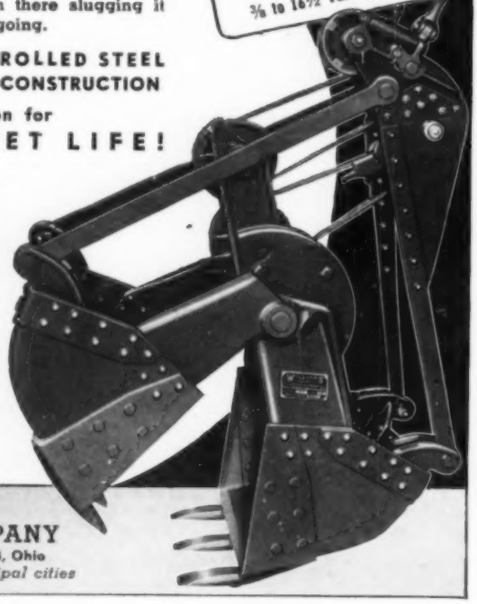
Staying Power

Multiple Rope & Power Arm Types
Dragline • Power Wheel • Dredging
Special Service Buckets
⅜ to 16½ Yd. Capacities

Wellman Buckets stay right in there slugging it out in the toughest, roughest going.

WELDED ROLLED STEEL CONSTRUCTION
is one big reason for
LONGER BUCKET LIFE!

Send for Free Bulletin
Tell us about your particular requirement and we will send full description of construction and special features in bulletins which clearly proves why YOUR NEXT BUCKET SHOULD BE A WELLMAN-WILLIAMS.



THE WELLMAN
ENGINEERING COMPANY
7017 Central Ave. Cleveland 4, Ohio
Sales and Service Agencies in principal cities

(Continued from page 114)

used to retard crawler drive wheels on one side of the vehicle while the tank makes the turn, the design for the other two curves was changed to 65-ft. radius, superelevated and widened to 60 ft.

Direction

The test track for the Detroit (Chrysler) tank arsenal was designed and constructed by the U. S. Engineers, Detroit District, in collaboration with the Ordnance Department, U. S. Army, and the Chrysler Corp., which operates the arsenal for the government. Actual construction was carried out in accordance with the plans by the Cooke Contracting Co., Detroit.

Under Lt. Col. Allison Miller, district engineer, Detroit District, U. S. Engineers, Capt. Howard E. Hill, chief, airfield branch, was in charge of design and construction of the test track. At the site, all field operations were under the direction of C. W. Kremer, project engineer during the first stage of construction, and P. H. Williams, project engineer for the second stage. Interests of the Chrysler Corporation were represented by Howard E. Mills, plant engineer. The Cooke Contracting Co.'s work was supervised by J. H. (Jack) Hohnke, general superintendent, with Henry C. Baer as superintendent in charge on the job.

★ ★ ★

Airdromes Around the World

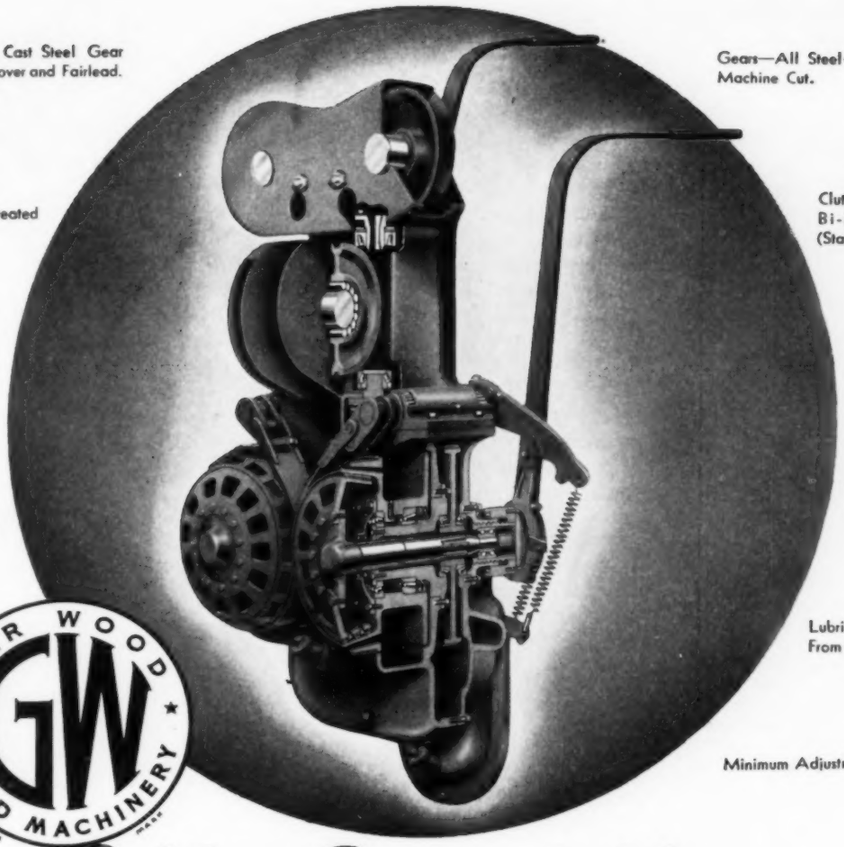
(Continued from page 58)

around Port Moresby have been bombed many times, and the hundreds of "hard standings" (dispersed parking areas for planes) are protected by huge earth revetments, which reduce the losses from high altitude bombing. Many of the runways have used the steel landing mat most effectively.

A number of fields with runways suitable only for very light planes have been built by native labor. For a wage of two shillings (40c.) a month plus a little food, these natives do simple construction jobs, and actually "tramp out" a runway with their feet.

Of particular interest to me was a forward fighter field only 40 mi. to the flanks of the Japanese position, which had been built entirely by one of our new

(Continued on page 120)


Heavy Cast Steel Gear Case, Cover and Fairlead.
Gears—All Steel—Machine Cut.
All Shafts Heat Treated and Ground.
Clutch—Cone Type with Bi-Metallic Facing (Standard Equipment).
Bearings—Ball and Roller.
Brake—Servo—External Band Type—Low Drag.
Ventilated—Clutch and Drum.
Large Sheaves.
Lubrication—Automatic From Gear Case.
Minimum Adjustments.

GAR WOOD GW ROAD MACHINERY

Cable Control Units

GIVE OUTSTANDING PERFORMANCE

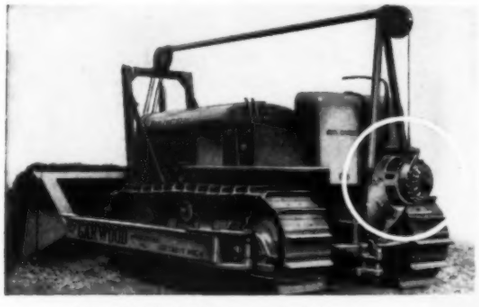
Features provided in the simplified "Clean-Cut" design of Gar Wood Cable Control Units make this "top" performance possible.

GW Road Machinery operated by Gar Wood Cable Control Units is a component fighting unit in the United Nations' drive for Victory!

SPECIFICATIONS

Cable Capacity (½"—6 x 19) Per Drum	185,
Line Pull—Bare Drum	7500 Lbs.
Line Pull—Full Drum	4530 Lbs.
Line Speed—Bare Drum (1-2-5 Trans. Gear)	270 Ft. Per Min.
Line Speed—Bare Drum (3-4-6 Trans. Gear)	433 Ft. Per Min.
Line Speed—Full Drum (1-2-5 Trans. Gear)	477 Ft. Per Min.
Line Speed—Full Drum (3-4-6 Trans. Gear)	718 Ft. Per Min.

The GW Road Machinery Line is Complete—Consisting of both Hydraulic and Cable-Operated Units



Gar Wood Bulldozer operated by SINGLE-DRUM Cable Control Unit.

Gar Wood earth-moving Scraper operated by GW DOUBLE-DRUM Cable Control Unit.

BONDS SPEED VICTORY

ROAD MACHINERY DIVISION
GAR WOOD INDUSTRIES, Inc.
DETROIT 11, MICHIGAN

GW ROAD MACHINERY is Sold Through
ALLIS-CHALMERS
Dealers Everywhere

(Continued from page 118)

type airborne Aviation Engineer battalions. No roads led to this valley, inaccessible except by air. But after some work of clearing and grass cutting by natives, supervised by our engineers, transport planes could be flown in carrying the battalion complete with its nineteen light bulldozers, graders, compressors, jeeps—and an extra complement of machine guns to provide for defense. Less than a month later this airdrome was complete, and served for the successful attacks by General Kenny's Air Force on Wewak and Lae.

After the landing of our troops near Lae and the capture by parachute troops of the landing strip at Nadjab, this airborne battalion, with others, was flown to Nadjab and initiated the rapid construction of airdromes in the Markham Valley *behind* the Jap lines at Lae. Thus, brilliant use has been made in this theater of this new time-saving technique of using airborne equipment. General MacArthur had in fact already demonstrated the possibilities of transport aviation in the campaign against Buna a year ago, when infantry, artillery, and engineer equipment and supplies were flown over

(Continued on page 122)

VIBER VIBRATORS ARE Interchangeable THAT MEANS less cost!

Experienced contractors need no "selling" on the speed and economy of placing concrete with Viber Vibrators. But do you realize that you can buy one Viber and add units for special jobs as needed! The Vibrator units are interchangeable, on flexible shafts, for large or small concrete sections —at minimum additional cost. Improved design of electric, gas and pneumatic motors assure longer life, greater efficiency—

AIR

Made in 1¾", 2½" and 3" diameter with 12 ft. and 21 ft. flexible shaft. Complete interchangeability of flexible casings, cores, vibrators. Operates on 80 lbs. pressure.

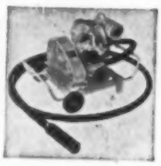
ELECTRIC

Made in 1¾", 2½" and 3" diameter with 12 ft. and 21 ft. flexible shaft. Complete interchangeability — Flexible Casings, Cores, Vibrators. Universal type motor. Built-in protective "ground."

GAS

Mercury clutch, entirely automatic, picks up load at 1500 r.p.m. allowing engine to idle without running vibrator, eliminates stalling, makes starting easy in cold weather.

Upsetting is practically eliminated in mounting. Handles allow complete unit to be easily carried.



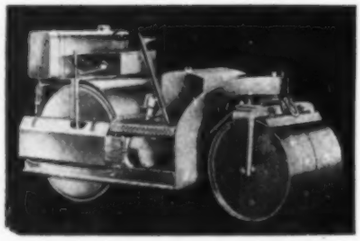
NEW CATALOG

Illustrates and describes the latest Viber equipment — gives complete data on casings, cores, speeds, power, weight, etc. Also new features. Also list of users and jobs where used. Write for your copy today.

VIBER COMPANY
726 South Flower St.
BURBANK, CALIFORNIA

C.H.&E.

3 Ton Roller



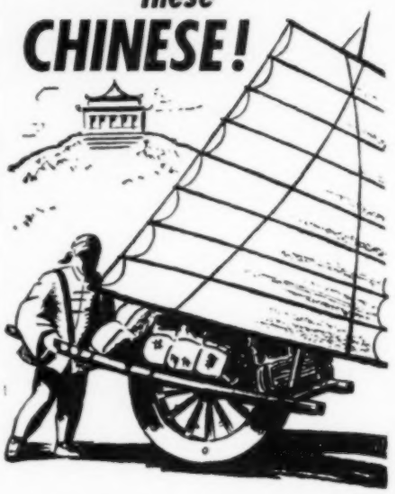
For rolling footpaths, driveways, sidewalks, tennis courts, playgrounds, and general maintenance work. The forward and reverse speed is controlled by one hand lever.

We also manufacture Saw Rigs — Pumps — Hoists — Bar Cutters and benders.

Write for catalog.

C. H. & E. Manufacturing Co.
3847 No. Palmer St.
Milwaukee 12, Wis.

Clever People these CHINESE!



Cargo-carrying wheelbarrows actually sail along the streets of the Orient. With typical Chinese ingenuity, a mast with sail is fixed at the front of the barrow, thus speeding up deliveries and lightening the task of the operator.

Obviously, today, Sterling Wheelbarrows do not have sails, but they are equipped with modern anti-friction bearings that enable heavier loads to be carried at a faster speed. Sterling balanced, easy-wheeling qualities simplify war-time material handling problems.

Sorry, only a few Sterlings are available at the present time. However, we're making plans now to take care of your requirements after the war.

STERLING Wheelbarrow Co.
Milwaukee 14, Wisconsin

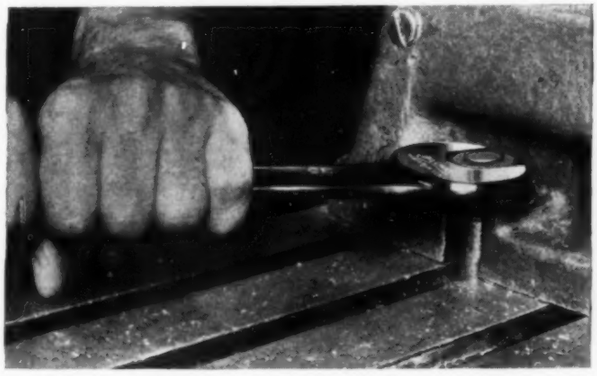
Sterling S
Look for this Mark of STERLING Quality
WHEELBARROWS

A 4307-½

THE HOW AND WHY OF WILLIAMS DROP-FORGED TOOLS

THE PROPER USE OF OPEN-END WRENCHES . . . Data Sheet No. 22

First, select a wrench with the correct size opening for the nut or bolt to be accommodated. Test this by the amount of free back and forth movement of the wrench on a stationary nut. Too large an opening may slip under a hard pull and injure you, the nut, or the wrench.

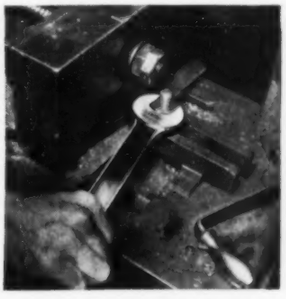


Any wrench will perform best and with highest strength when squarely and fully seated on the nut or bolt head as shown above. Pull straight, avoiding side strain or "cramping" of the wrench. Nine times out of ten you will find it safer to *pull* rather than *push* on a wrench. Greasy hands... or greasy wrenches... are dangerous. A dry, clean grip always permits the hardest, safest pull and helps to reduce accidents.

Never use a wrench with a badly worn or chewed and spread opening as pictured above—particularly on hex nuts. Williams' Wrenches are stamped with the nominal size of their openings; that is, the size of the nut or bolt head across the hex or square flats. Openings are made .005" to .040" (proportionate to size) larger than the nut or bolt head they are intended to fit. It is, therefore, easy to detect spread openings.

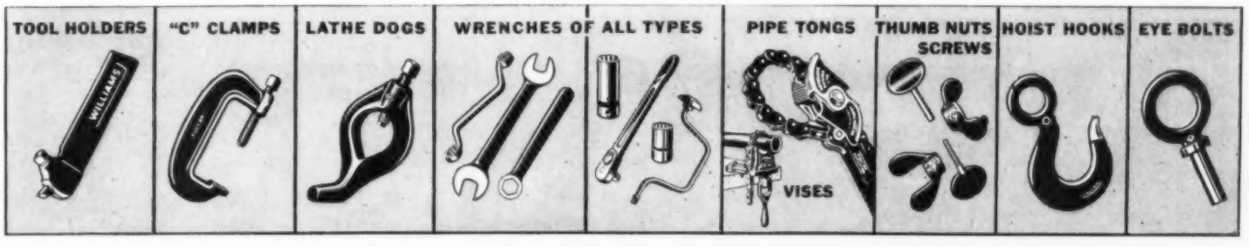
Standard commercial wrench leverages are such that an average man can readily break bolts or strip threads up to 5/8" bolt diameter. Consequently care should be exercised and a sense of "feel" developed. Bolts larger than 5/8" seldom can be set up too tight with average wrench leverages. If you must use auxiliary leverage on large bolt sizes, such as a pipe extension over the handle, make sure the two are strongly and well coupled. The best and safest procedure is to purchase special wrenches with extra long handles.

Never hammer an ordinary wrench handle as a substitute for increased leverage. *Striking-face* wrenches, (see above illustration) made specially for this purpose, should be used. A vast amount of energy is stored in several sharp hammer blows, and ordinary wrenches are not designed to withstand this abuse.



When the usual open-end wrench is operated in close quarters on hard-to-get-at nuts, it should be remembered that "flopping" the wrench upside down between swings gives an angular advantage which permits continuously rotating the nut, or bolt in the least possible space. By this "flopping" trick, illustrated above, the usual 15° angle wrench will operate a hexagon continuously where the swing is limited to 30°; otherwise 60° would be necessary.

Sold by Leading Industrial Distributors Everywhere . . . J. H. Williams & Co., Buffalo 7, N. Y.



DAVEY COMPRESSORS ARE PREFERRED BY REPEAT PURCHASERS

Scores of discriminating firms have found that Davey Compressors deliver longer, more dependable service at lower cost. That's why they buy Davey Air-Cooled Compressors *again* and *again.*

The four Davey Aristocrats in the picture are part of a fleet of Model 160 units, which has been built up by steady additions of new Davey Compressors over a period of years.

Before you order your next compressor, check with some of the outstanding Davey users.

Complete line of Davey Portable and Stationary Compressors in 60, 105, 160, 210 and 315 cubic feet sizes . . . Heavy-Duty Truck Power Take-Offs . . . Pneumatic Saws.

WRITE FOR NEW CATALOG E-172

Some Distinguished Users Of Davey Compressors

American Telephone and Telegraph Co. • Connecticut Light & Power Company • Globe Contracting Company • Barker Bros. Construction Co. • Georgia State Highway Department

ARMY E NAVY

DAVEY *Compressor Co.*
KENT, OHIO
DEALERS IN PRINCIPAL CITIES

(Continued from page 120)

the Owen Stanley Mountains. In the "new patterns of warfare" which he mentioned in one report, the Engineer is playing a vital part.

South Pacific Theater

In the South Pacific, where General Harmon and his Army Air and Ground Forces support Admiral Halsey and the Navy, the work of the Naval Construction Battalions (Seabees) is conspicious. These excellent construction units have built many airdromes, as well as naval bases. Supplemented by our Aviation Engineers I found them active all the way up to Guadalcanal and the battle-scarred area around Munda.

In this theater most of the runways have been constructed of coral, which packs well and gives an excellent surface. In some cases steel landing mat has been placed on top of the coral for a wearing surface.

Considerable use is made here of native construction, with thatched covered structures. A warehouse of this character can be built for $50.

Hawaii

The magnificent layout at Hawaii is impressive. Here is a secure base which reflects a vast construction effort since Pearl Harbor, including much underground construction. The camouflage technique too is admirable, whereas in other theaters there has been scant time for elaborate camouflage plans to be carried out.

Here again the Seabees are much in evidence, while a smaller number of Aviation Engineer battalions supplement their efforts in providing air bases as springboards for the Navy and Army amphibious operations against the Gilbert and Marshall Islands.

Alaska

My recent itinerary did not include Alaska, but a previous visit had impressed me with the tremendous difficulties of operating in this distant theater with its treacherous weather. Despite these difficulties our Army Engineers had met and conquered the task of building successive airdromes on one barren Aleutian Island after another. When the Japs attacked Dutch Harbor, they met with unexpected resistance from *land-based* planes! A steel landing mat placed secretly not far away thus contributed vitally to the successful defense. A few months later, an Aviation Engineer battalion, starting from scratch on a barren island, had a runway for Flying Fortresses in operation in 11 days. And so on, west-

(Continued on page 124)

Make MONOTUBES

The "Foundation" of Your Future Plans . . .

When war ends and the delayed construction of new buildings, bridges, underpasses, and highways begins—get off to a good start with MONOTUBES.

Monotubes have proved favorites with engineers and contractors for the installation of cast-in-place concrete piling because they are . . .

Easy To Handle. Monotube steel casings are light in weight and can be handled quickly and economically.

Fast To Drive. Monotubes are so strong and rigid they require no heavy core or mandrel and can be driven with average job equipment.

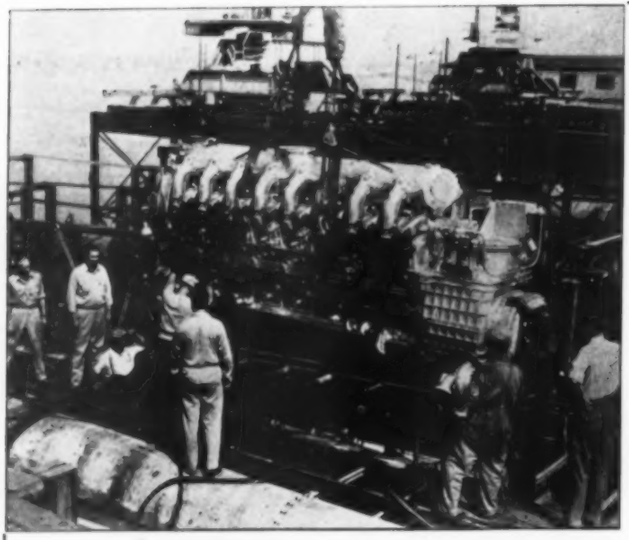
Simple To Extend. The use of Extendible Monotubes proves economical and speedy where varying ground conditions require a variety of lengths.

Quick To Inspect. The hollow tubular design of Monotubes enables you to inspect these casings quickly and thoroughly from top to toe prior to concreting.

Monotubes are available now for war plant construction (and after the war for all construction) in a wide range of gauges, sizes, and tapers to meet exacting requirements in varying soil conditions. Write for Catalog 68A to The Union Metal Manufacturing Company, Canton 5, Ohio.

UNION METAL

Monotube Pile Casings



SMALL TOOLS for BIG JOBS

THAT'S THE WHOLE STORY ABOUT

COFFING SAFETY PULL HOISTS

Construction and Maintenance men say they use "Safety-Pulls" for 101 odd jobs. Wherever a lift or pull is needed the "Safety-Pull" will do the job safely, quickly and economically. Capacities from ¾ to 15 tons, yet these light weight, powerful tools weigh only 14 to 150 lbs. *Write for Catalog No. DG-6.*

COFFING HOIST COMPANY

800 WATER STREET **DANVILLE, ILL.**

Hungry for yardage

YOU CAN SEE what these ditcher teeth are up against! Trenching in sandy soil! Yet, because of their abrasion-defying hard-facing of Coast Metals, they serve better, last longer!

These Ditcher Teeth Stay Square-Cornered, Sharp-Cutting LONGER

And at a surprisingly low cost,—in comparison both with new teeth replacements and with other hard-facing materials. Here, the saving over the hard-facing material formerly used was 40%!

COAST METALS HARD-FACING is your best answer to tough maintenance problems. Applied to road graders, levelers, bulldozers, slip scrapers,—in fact to all blades, cutters and scoops on equipment of this type for cutting, scraping, digging and loading earth, it makes your equipment last several times longer.

COAST METALS, INC.

Plant and General Offices: Canton, Ohio

Executive Offices: New York, N.Y.

COAST METALS *hard-facing weld rods*

YOUR EQUIPMENT'S LIFE PRESERVER AGAINST WEAR

(Continued from page 122)

ward, until our superior Air and Ground and Naval strength had made these islands untenable for the Japs.

Thus, in every theater of war the Army Engineers are building airdromes—and building them with a real sense of urgency. The swift movement and high venture of the fighter and bomber will never belong to the Air Force Engineer. Runways are roadways and their building is usually not spectacular. Yet, without these runways the fleetest planes and ablest flyers would be powerless. The bulldozer must accompany—or even precede—the airplane into every new theater of war. And thus the Engineer sets the stage for aerial offensive that strikes deeper and deeper into enemy-held territory.

★ ★ ★

Post-War Highways

(Continued from page 77)

recent years has shifted to financing of special projects. Many of these have proved to be excellent investments. With the advent of the highway holiday caused by the war, many states may find that a large mileage of highways will have worn out and become wholly inadequate after the war. This is particularly true of trunk lines in heavily populated areas where two lanes have been carrying four-lane traffic for many years.

These states might find it advantageous to resort to bond financing, as this is generally high-cost per mile construction and current revenues in many instances would be insufficient to provide the financing for immediate use. Delaying this type of work over a period of years due to lack of current income would result in high maintenance costs, excessive time losses, and high operating costs. It would be cheaper in many cases to borrow sufficient funds for the needed modernization.

During the early years at least of the post-war period, there will be capital available for sound investment. The purchase of highway bonds would not only finance the needed facilities and give employment but would serve as an outlet for idle funds which after the last war went into speculation. The hesitance concerning the future of motor vehicle traffic which existed in the early twenties will not exist when this war is won. Hence a program of highway construction to provide for a large volume of

(Continued on page 126)

Remember -
THEY AREN'T LICKED YET!
Brilliant United Nations victories in Europe and in the Pacific are only a beginning—the costly struggle lies ahead. Money, equipment and men are needed in increasing quantities and numbers before complete and final victory is ours. Remember, the enemy is powerful—they aren't licked yet! So don't relax now—
BUY MORE WAR BONDS THAN YOU EVER BOUGHT BEFORE!
• The test of war is resulting in Michigan Mobile Cranes and Shovels with features more outstanding than ever . . . These new MICHIGANS will help you to greater profits after victory . . . For complete information write for Bulletin CM-24.
AIR CONTROLLED
MICHIGAN
POWER SHOVEL CO.
BENTON HARBOR, MICHIGAN

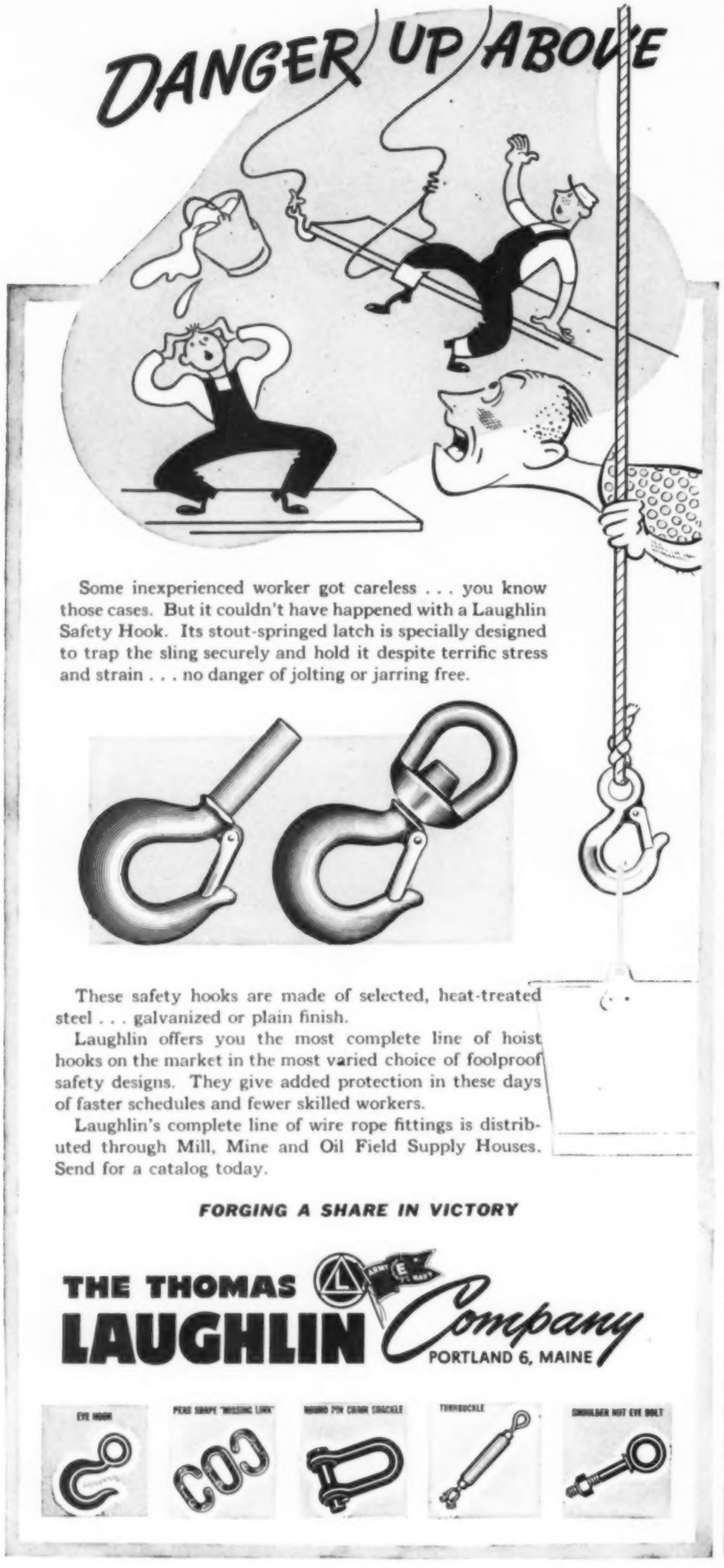
(Continued from page 124)

motor vehicles in future years can be hardly overdone.

Estimates made in the early twenties on vehicle increase for the following ten years were much too low. Superhighways, limited access roads, and cloverleaf intersections did not enter the road builders' vocabulary until late in the twenties. They could have been under consideration directly following World War I without committing any error in forecasting. Motor vehicle increase in the 1919-1929 period amounted to 19,000,000. This figure should be exceeded in the ten years following the present war if the highway facilities are adequate. There is no reason now for committing the forecasting errors of 1920 concerning the future of automobile transportation. Its expansion is certain if modern highways are provided.

Financing becomes a problem when and only when highway expenditures are considered a tax burden and not an investment. Federal aid and motor vehicle revenues must be the major sources of funds, but along with these the possibility of utilizing private capital in the financing of many miles of highways and countless structures looms large in the

(Continued on page 128)



Some inexperienced worker got careless . . . you know those cases. But it couldn't have happened with a Laughlin Safety Hook. Its stout-springed latch is specially designed to trap the sling securely and hold it despite terrific stress and strain . . . no danger of jolting or jarring free.

These safety hooks are made of selected, heat-treated steel . . . galvanized or plain finish.

Laughlin offers you the most complete line of hoist hooks on the market in the most varied choice of foolproof safety designs. They give added protection in these days of faster schedules and fewer skilled workers.

Laughlin's complete line of wire rope fittings is distributed through Mill, Mine and Oil Field Supply Houses. Send for a catalog today.

FORGING A SHARE IN VICTORY

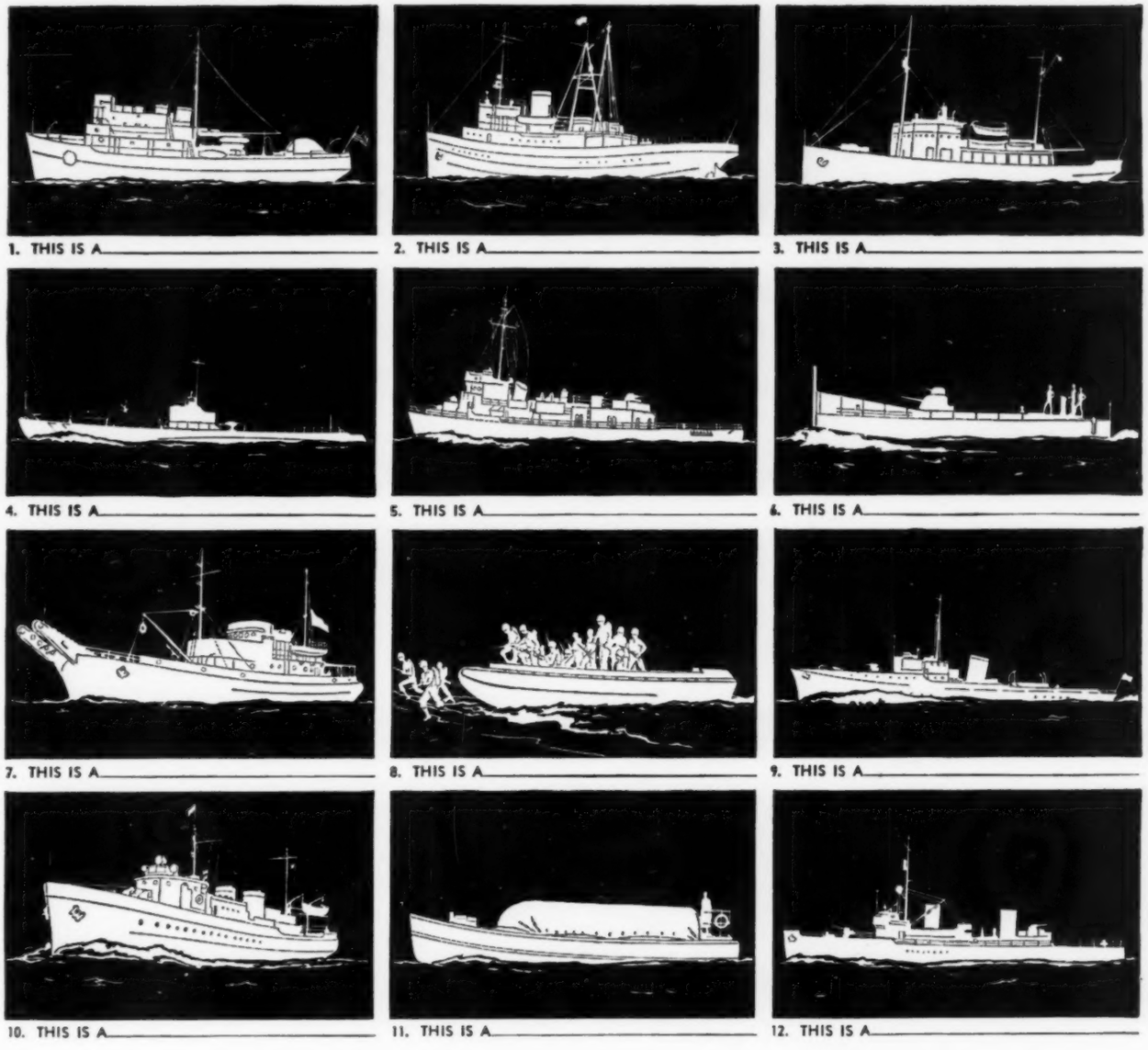
THE THOMAS LAUGHLIN Company
PORTLAND 6, MAINE

When There's No Time for Breakdowns It's Time to Get a Gorman-Rupp Pump

Today, when time is the essence, you need a Gorman-Rupp Self-Priming Centrifugal Pump more than ever. There is not a quitter among them. The water passage has the same area as the suction hose. Muck, gravel, cinders — you simply can't clog them because solids cannot accumulate. There is no recirculation orifice to clog — no shut-off valve to jam — no hand priming regulator. There isn't a self-priming centrifugal pump made that will outwork a Gorman-Rupp in gallonage or continuous hours. Gas engine or electric motor driven. Capacities up to 125,000 GPH. There is a type and style to fit your every requirement. Stock for immediate delivery in 100 principal cities.

THE GORMAN-RUPP COMPANY, MANSFIELD, OHIO

GORMAN-RUPP
Self-Priming Centrifugal Pumps



How many can you identify?

These boats do the "leg work" for our fleet. Their jobs are not always spectacular—but each has a critical assignment in the blueprint for victory, none must fail at a moment of decision. That's why the Diesel engines in so many of them are lubricated with Standard of California's RPM DELO.

RPM DELO ends the costly annoyance of stuck rings in Diesels. It banishes fear of bearing corrosion, stops sludge and deposits, cuts wear to the thinnest minimum.

To double the interval between overhauls in your Diesels, to cut repair bills in half—switch to RPM DELO. No other Diesel lubricant combines its anti-oxidant, non-corrosive and detergent qualities. It's America's finest Diesel lubricant.

The ships illustrated are: 1. Coastal mine sweeper. 2. Tug. 3. Coast Guard cutter. 4. Submarine. 5. Destroyer escort. 6. Tank lighter. 7. Net tender. 8. Troop landing boat. 9. Submarine chaser. 10. Coast Guard patrol boat. 11. Launch. 12. Fleet mine sweeper.

ORDER RPM DELO FOR YOUR DIESELS

RPM DELO

RPM DELO is marketed under these names:

RPM DELO • Caltex RPM DELO • Kyso RPM DELO
Signal RPM DELO • Sohio RPM DELO
Imperial-RPM DELO
CONCENTRATE

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity

STANDARD OF CALIFORNIA

BODIES and HOISTS LIKE THESE by HERCULES...

Hercules High Dumper
Power up, Power down

Hercules Braced Side Rub Rail Body

are giving maximum service with minimum expense, day after day, on the home front.

"Victory is our business", and our war production is playing an important part in bringing victory nearer; but production for essential civilian use is also important, and we're able to make quick deliveries on many types of Hercules Hydraulic Hoists and Bodies to you.

See your Hercules Distributor, or send inquiries direct to us.

HERCULES STEEL PRODUCTS CO.
GALION, OHIO

BROWNHOIST BUCKETS

The greedy jaws of Brownhoist clamshell buckets speed up material handling in dirt, clay, coal, gravel and ore. Their deep, clean bites practically eliminate hand shoveling. Extra sturdy. Large sheaves reduce rope wear to a minimum. AVAILABLE IN ROPE-REEVE, POWER-WHEEL AND LINK-TYPE. For facts and prices write to Industrial Brownhoist Corporation, Bay City, Michigan. Offices in New York City, Philadelphia, Pittsburgh, Cleveland and Chicago.

(Continued from page 126)

financial picture. Highway and bridge bonds have proved to be profitable investments on many modern improvements in recent years. Bonds amounting to $400,000,000 have financed the construction of bridges and tunnels. These bonds were serviced either by motor-vehicle taxes or tolls. Special highway projects amounting to $120,000,000 have been financed by the same method.

Self-Liquidating Facilities

The Merritt Parkway in Connecticut with a toll of only 20 c. for the 37-mi. section would have paid about 3.3 percent on the $15,000,000 loan, if it had been used for that purpose. The income in this case is being used for the extension of the highway and the bonds are serviced by motor-vehicle revenue. Bonds amounting to $40,000,000 were used in financing the Pennsylvania Turnpike and up to August, 1941, income from tolls amounted to 6.4 percent on this investment. The San Francisco Bay bridge, which cost $70,000,000, is a particularly successful bond financing project, since traffic in 1940 amounted to 15,000,000 as compared to a predicted 6,000,000. This induced traffic resulting from the construction of a modern time-saving transportation facility has caused the toll charge to be twice lowered, according to Dr. L. I. Hewes, chief, Western Region, Public Roads Administration.

The Havre DeGrace Bridge over the Susquehanna river, Maryland, has more than paid its way. Toll projects around New York City have in most instances more than paid off on their investment. Of the 17 existing, 11 produced income amounting to more than $22,000,000 in 1940. These facilities are being financed by private capital. During the post-war period there should be many well chosen projects which will be attractive to the private investor. This method of financing should be given consideration for several reasons: First, it does not require increase in government income; second, it provides an outlet for private capital; and third, it places private funds in the production of durable goods, the industry which has been greatly over-expanded in war production and the industry where the greatest unemployment will occur when normal peacetime production is resumed.

Highway Post-War Plans

Highway agencies that find it possible to accumulate post-war highway reserve funds will be in an enviable position when the war is over. Some states will have such reserves. Others are hard

(Continued on page 130)

Cutting Dadoes or Grooves of any width is quick work with Grooving Blade.

Cutting Through Nails in old floor work won't hurt the Nail Cutting Blade.

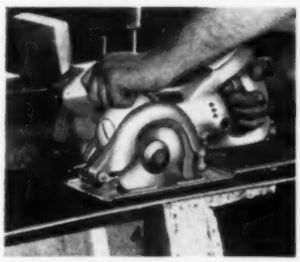
Cutting Corrugated Sheet, or other ferrous metals, with Abrasive Disc.

Trimming Odd Lengths of lumber on sheathing work with Cross Cut Blade.

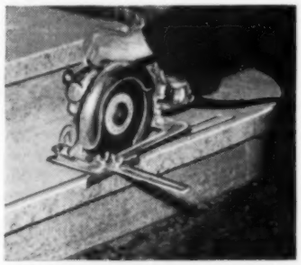
Cutting Stone Slabs, slate, marble, tile, transite, etc., with Abrasive Disc.

Quick-Saws Make 'Most Any Cut in 'Most Any Material

BLACK & DECKER Quick-Saws do any job faster, better and at a better profit!



Cutting Laminated and Veneer Woods with Planer Blade.



Slotting Stone Steps for non-skid strips with Abrasive Disc.

Pictured here are some of the many kinds of work on which Black & Decker Electric Quick-Saws—equipped with the right blades or abrasive discs—give you better workmanship, in less time, at lower cost. Made in three models: No. 75, cuts to 2 3/8" depth, $105.00; No. 85, cuts to 2 5/8" depth, $122.00; No. 95, cuts to 3 1/8" depth, $140.00. Our big, free "Electric Saw Handbook" gives more facts about Black & Decker Quick-Saws, attachments and uses. For a copy address: The Black & Decker Mfg. Co., 759 Pennsylvania Ave., Towson-4, Md.

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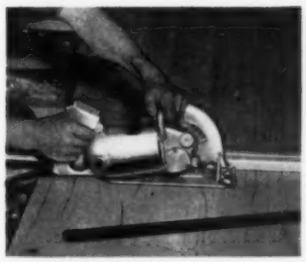
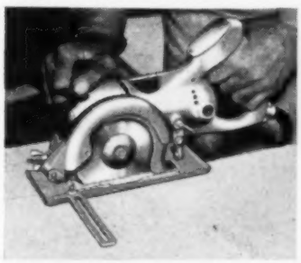
PORTABLE ELECTRIC **TOOLS**



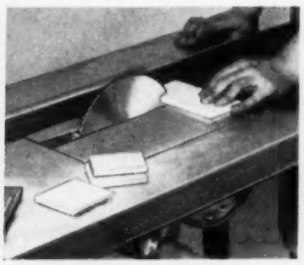
Cutting Groove for bowling alley foul line with Grooving Blade.

Cutting Bevels and Angles for indoor trim with Cross Cut Blade.



Cutting Soft Compo-Board without snagging; Compo-B'd. Blade.

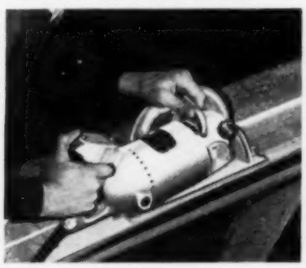
Cutting Corrugated Asbestos, tile, transite, with Abrasive Disc.



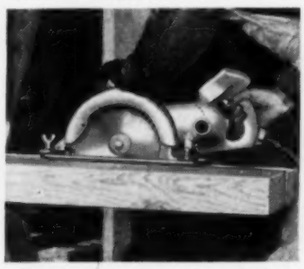
Cutting Tile on B. & D. Saw in saw table, with Abrasive Disc.

Cutting Stair Stringers or notching timbers; Combination Blade.

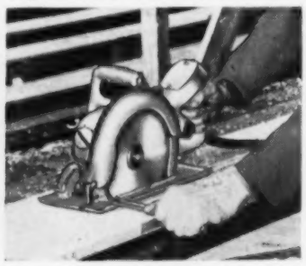
Cutting Sheet Lead, copper, brass, etc., with Metal Cutting Blade.



Cutting Rabbets ten times as fast as by hand with Grooving Blade.



Making Extra Deep Cuts is fast work with Combination Blade.



Planer Blades make very smooth cuts—on ripping or crosscutting.

(Continued from page 128)

pressed to meet maintenance requirements and fixed obligations due to decreasing revenues and diversion. Motor revenues used for other purposes than highways have averaged around $200,000,000 for the last several years and this is a major reason that the highway program has not been adequate to meet the demands for many years.

Surveys made by the American Road Builders' Association indicate a huge program of needed highway work in states, counties and cities. Questionnaire returns from 41 state highway departments set needed construction of roads and bridges at $6,000,000,000. This would approximate a total of $7,000,000,000 for all states. Returns from 146 cities show needed work amounting to $586,000,000 for streets and bridges. The total for all cities over 10,000 population would approximate $4,000,000,000.

Returns from 181 counties show needed work amounting to $752,000,000. The total for all counties which carry on roadbuilding would be well over $4,000,000,000. The American Association of State Highway Officials, under the headings of needed rebuilding, widening and relocating, shows a total of $7,000,000,000 of needed highway and bridge

(Continued on page 132)

HARD HITTING RESULT PRODUCING Blows

SUPER-VULCAN
OPEN TYPE
Differential Acting
PILE HAMMERS
18C-30C-50C and 80C

In pile driving you immediately begin costs savings with Super-VULCAN on the job. In addition you anticipate your construction schedule as far as the pile driving is concerned—resulting in an earlier start on the construction operations that follow. It's like stepping up production. With the Super-VULCAN you get twice the blows per minute—more piles driven per dollar — less steam used. These Pile Hammers have rugged strength — simple design—positive action—easy to operate—are durable and fit the same leads and use the same accessories as the VULCAN Single - Acting Pile Hammers.

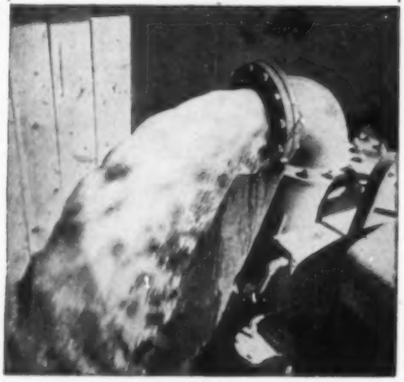
Sizes 18C—30C—50C—80C meet all needs

Write for details.

VULCAN IRON WORKS Since 1852
331 North Bell Avenue
Chicago Illinois

DUAL PRIME CENTRIFUGAL PUMPS

FAST—SURE—DOUBLE PRIMING!



These are the Big 10" Pumps that removed the bulk of the water on the U.S.S. "Lafayette" job. Available in sizes from 1½ to 10". Get the CMC Pump Catalog. FREE ON REQUEST.

CONSTRUCTION MACHINERY CO.
WATERLOO, IOWA

Sonotube

Concrete Pier Forms

Laminated Fibre Tubes
up to 24 feet long

6 Standard Sizes

INSIDE DIAMETER					
8"	9"	10"	11¼"	12"	13½"
SQUARE INCHES					
50.26	64	78.54	100	113.1	144

Smaller sizes available.

IMMEDIATE DELIVERY

A two operation job to make pier forms—cut to length (pier height)—brace or back-fill on footing—and it's ready to pour.

Thoroughly tested in war construction and widely accepted and used. Saves time—money—material—labor. . . Successfully used for piers up to 10' heights.

ARMY E NAVY

Write for Delivered Prices

SONOCO PRODUCTS COMPANY
HARTSVILLE, S. C. MYSTIC, CONN.
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QUALITY CONSTRUCTION
QUANTITY PRODUCTION
ECONOMICAL COST

WOOD *ROAD-MIX* PAVING

TAKES TOUGH BEATING FROM HEAVY TRUCK TRAFFIC

OVER 3 YEARS OLD AND NOT *ONE CENT* FOR MAINTENANCE

A piece of paving is only as good as the material that goes into it—the mix is only as good as the control! Here's a piece of paving in the city of Long Beach, Calif.—14th Street between San Francisco and Oregon Avenues, part of 60 miles of Wood Roadmixer paving in this city. This street is used by oil tank trucks, produce trucks, ice trucks and other heavy equipment. It takes a terrific pounding 24 hours a day—and it hasn't required one cent of maintenance since it was laid in October, 1941.

That's performance and quality. That's what you get with road-mix paving mixed with a Wood Roadmixer.

This job is built of 4" of decomposed granite, 1" down to minus 200, and was mixed with the proper percentage of SC4 asphalt. Surface had a double shot seal. Proper grading of aggregate was important in the production of this top quality, lower cost job.

This is only one of scores of examples of Wood Roadmixer construction on all types of paving, and is conclusive proof that you, too, can profitably "Design For Road-Mix"—and use a Wood Roadmixer, a complete traveling mixing plant.

WRITE FOR BULLETIN AND PRICES

DESIGN FOR ROAD-MIX

WOOD ROADMIXER

Wood Manufacturing Co. • 816 West 5th St., Los Angeles 13, California

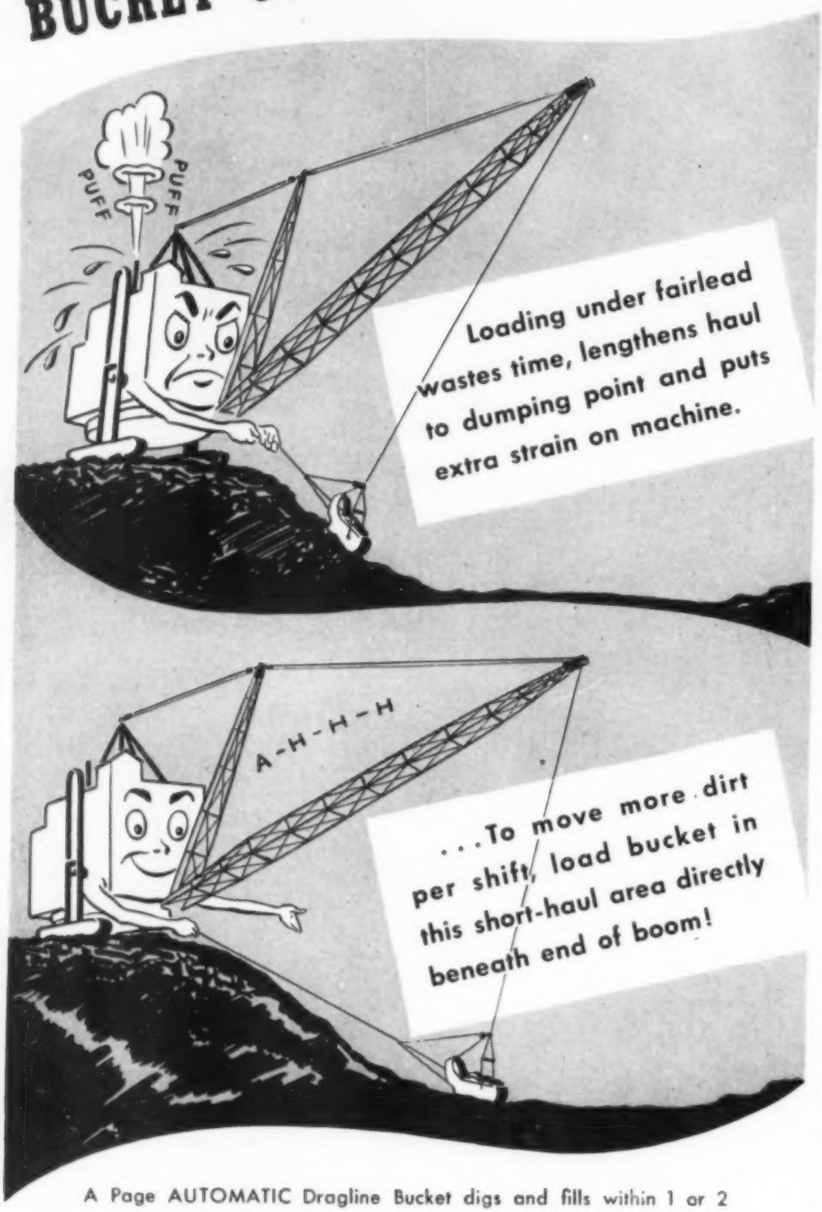
(Continued from page 130)

construction and reconstruction. In another survey including new construction on the federal aid system, the secondary system and the urban system, the total amounts to $11,000,000,000.

Obviously there is plenty of needed highway work for post-war construction operation if the plans can be prepared and financing provided. The important question is whether this work will be ready for contract when the demand occurs. Lack of finances and manpower have been major hindrances. State highway departments report that on January 1, 1945, they will have projects, with rights-of-way obtained, ready for letting amounting to $1,000,000,000 and projects without rights-of-way but otherwise ready amounting to $400,000,000. Projects included in both categories would build a total of 35,000 mi. and 2,300 bridges. This would appear to be a satisfactory start if the projects were evenly distributed. Unfortunately, a large percentage of this work would be carried on in a comparatively few states. All states have demonstrated that there is a sizeable needed highway program. All states should be set and ready to go ahead when the occasion arises, if the maximum benefits are to accrue to transportation and employment.

DRAGLINE PRODUCTION TIP NO. 1

DON'T LOAD THE BUCKET UNDER THE FAIRLEAD!


PUFF
PUFF
PUFF
Loading under fairlead wastes time, lengthens haul to dumping point and puts extra strain on machine.
A-H-H-H
...To move more dirt per shift, load bucket in this short-haul area directly beneath end of boom!

A Page AUTOMATIC Dragline Bucket digs and fills within 1 or 2 bucket lengths . . . no need to drag it in close to get a full load. Size for size and weight for weight, a Page AUTOMATIC will outdig any other dragline bucket made!

PAGE *Automatic* DRAGLINE BUCKETS

PAGE ENGINEERING COMPANY, CHICAGO 38, ILLINOIS

SYNTRON

DEPENDABLE

ELECTRIC HAMMERS

Only One Working Part—THE PISTON

Can SAVE You—
$4.00 every hour they're used—that amounts to $160.00 per week.

DRILLING CONCRETE
POINTING MASONRY
VIBRATING FORMS
SCALING METAL
CUTTING & CHIPPING
REDRESSING

Four "Heavy-Duty" Models

"MK" — 5/8" cap. at $105.00
#16 — 1 1/8" " " $150.00
#22 — 1 1/2" " " $195.00
#25 — 2" " " $225.00

SYNTRON CO.
500 Lexington Homer City, Pa.

Galion

ROLLERS and GRADERS

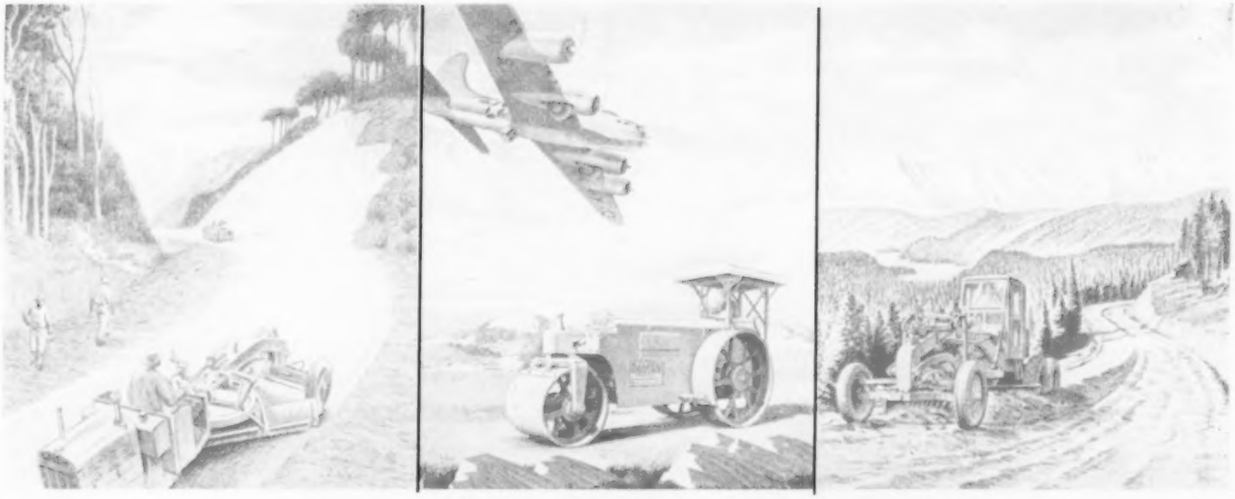
Thousands of Galion machines are engaged in vital war construction including new roads, airfields, docks, and bases. The contractors and engineers operating Galion rollers and graders are obtaining valuable training. This training will not be wasted for there will be more progressive construction in the post-war period.

Already proved in this war construction, Galion units will again serve after the war in reconstruction here and abroad. It will pay you to remember Galion in your post-war planning.

With a war in progress and the resultant rationing of gasoline we are not so much concerned with the inadequacy of our highway facilities . . . but after the war is another thing. The Federal, State and County governments are looking forward to the needs of tomorrow's traffic . . . are doing something about it NOW.

THE GALION IRON WORKS & MFG. CO.

MAIN OFFICE AND WORKS: 1907 — 1944 GALION, OHIO



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A DOZEN REASONS WHY— Skullgards PROVIDE THE BEST HEAD SAFETY FOR YOUR WORKERS!

★ Laminated bakelite construction protects against bumps and falling or flying objects.

★ Extra protection afforded by steel screen in crown molded integrally with bakelite.

★ Deep crown for fullest protection — rounded contours deflect flying objects.

★ High dielectric strength.

★ Light weight — comfortable as an old felt hat.

★ Smooth surface inside and out.

★ Easy to keep clean and sterilize.

★ Impervious to moisture, heat, common chemicals.

★ Uniform in thickness throughout.

★ Reinforced bead on brim.

★ Ample ventilation between sweat band and wall.

★ Easy removal of lining for replacement.

Check these outstanding features and you'll *know* why M. S. A. Skullgards are the world's most popular work hats!

For outstanding production achievement . . . the Maritime "M" Pennant and Victory Fleet Flag, awarded to M. S. A. by the U. S. Maritime Commission.

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS AND MEADE STREETS · PITTSBURGH, PENNA.

District Representatives in Principal Cities

Inter-American Highway

(Continued from page 73)

Mexican railroad authorities, the opening of the bridge permits shipments on through bills of lading from any railroad point in the United States to Ayutla, Guatemala. The narrow gage rolling stock has roughly one-half the car capacity tonnage of the standard gage cars, and a shipment of ten or twelve cars from Nogales or Laredo carried through to Ayutla furnished two full trainloads for the narrow gage. It was found desirable to keep tracers and expediters in the field to hold the shipments together and keep them moving. In going through, from the United States border to Ayutla, line interchanges occur at Guadelajara, Mexico City, and Vera Cruz, and until the Mexican National Railways are in better shape to handle shipments rapidly on the international section south of Vera Cruz, this route to Central America will not be altogether satisfactory.

By transshipping again to La Union, Salvador, to barges operating across the

(Continued on page 136)

Degreasing Repair Parts

When cleaning motor blocks, transmissions, carburetors and other automotive parts, use SAFE, fast-working Oakite degreasing materials.

You'll find they speedily, thoroughly remove dirt, grease and oil . . . make inspection and repair work easier . . . provide dependable results that help you expedite servicing and reduce maintenance costs. Write TODAY for FREE booklet giving full details!

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Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* CLEANING
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

EMERGENCIES REQUIRE QUICK ACTION!

Schramm Compressors furnish air on moment's notice!

Merely by easily moving a Schramm Air Compressor onto the job—and touching a starter button—you get all the compressed air you want—and the emergency job is sped along!

Illustrating the time Schramm was needed to furnish air so that a road atop a busy highway bridge leading to a state capitol could be repaired—quickly!

Schramm met all requirements because it could furnish the necessary air speedily—and the unit was lightweight and compact and thus easily towed about. This represented a big saving in hauling costs—plus plenty of action.

Many features contribute to "air-when-you-want-it" Schramm Compressors: (1) Completely water cooled to provide ideal performance both winter and summer. (2) Seven main bearing supports. (3) Mechanical intake valve. (4) More cylinders and lighter parts. (5) Forced feed lubrication.

If you are not already using a Schramm Air Compressor, it will pay you to write today for illustrated Bulletin 42-PA.

SCHRAMM INC.
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

"CLEVELANDS"

For Superior Ditching Performance Always!

THE CLEVELAND TRENCHER COMPANY
20100 ST. CLAIR AVE. "Pioneer of the Small Trencher" CLEVELAND, OHIO
"CLEVELANDS" Save More... Because they Do More

Coast Guns go into position

EXPERIENCE *builds 'em*
PERFORMANCE *sells 'em*

ON ROGERS TRAILERS

SAFE from Invasion is no idle boast today The enemy has been driven from the Alaskan outposts and they dare not attack us here!

ROGERS TRAILERS have played a big part in fortifying our coastlines and they are fighting with our men overseas!

The ROGERS TRAILERS which will be available to industry when present war contracts are completed, will be better-engineered and more efficient than the thousands which have been operated so successfully for many years.

ROGERS BROS. CORPORATION
Albion, Penna.

(Continued from page 134)

Gulf of Fonseca, it would be possible to reach both Honduras and Nicaragua by this route. For ordinary commercial shipments, however, the cost would be prohibitive and no faster than normal steamship service.

The location of some of the incompleted sections of highway, especially in southern Costa Rica, was so isolated that access roads had to be constructed from available ports across the coast range to El General Valley. Two such approaches were built. One, known as the Dominical road, extended from the beach at Dominical about 105 mi. below Puntarenas, and 30 mi. below Quepos on the Pacific Coast

ROCK CRUSHER near San Isidro, Costa Rica, produces material for surfacing Dominical access road.
Public Roads Administration Photo

of Costa Rica to San Isidro, on El General River, a distance of about 34 mi. This route started at sea level, crossed the coast range at about 5,000 ft. elevation and descended to San Isidro at about 2,500 ft. above sea datum. It required a rough crushed stone surface to make it serviceable because of the heavy rains in the coastal mountains during about seven months of the year.

Shipments by this route are delivered at Puntarenas or Quepos and loaded on barges. The barges are towed to Dominical, beached on the tide, unloaded with the use of ramps or a 50-ton stiff-leg derrick, and from this point equipment, supplies, and materials are being taken over 35 mi. of access road to El General Valley. Seven or eight steel truss bridges, up to 200-ft. span, will go in this way, together with fuel oil, lubricants, cement, reinforcing steel, metal pipe culvert, explosives, and camp supplies.

Around Golfito in southern Costa Rica, a deep-water port with wharf and heavy lift facilities, the United Fruit Co. operates a series of banana farms, and a narrow gage railroad extending some distance into the interior and along the coast is available to the foot of the coast range. One branch of this road was extended

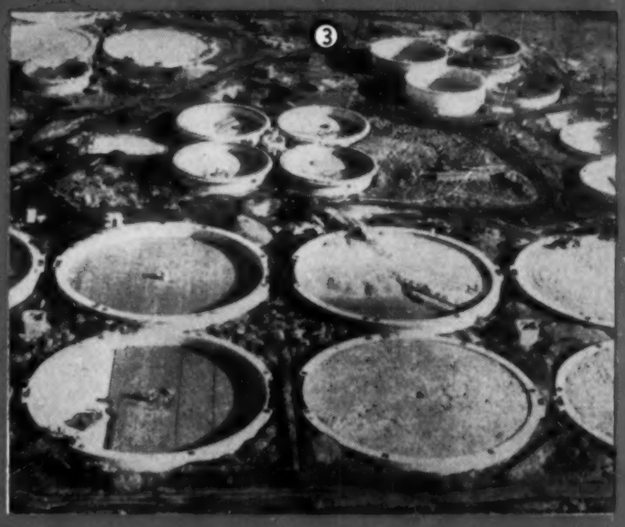
(Continued on page 138)

When your problem involves

PLACING CONCRETE . . .

Illustrated: Economy Steel Forms in use on ① Foundation ② Box-Tunnel ③ Sewage-Treatment Plant

Buildings, foundations, tanks, tunnels, culverts, bridge-piers and abutments, all are easily formed with standard Economy units. Economy service provides estimates, form-erection drawings, forms and accessories, trained foremen and plate-setters for contractor to employ. You rent Economy equipment, only as much as you need, only as long as you need it. RESULT: substantial savings in time and material. On any project, be sure your bid takes advantage of these savings.



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ECONOMY STEEL FORMS

A nation-wide form-rental and engineering service that saves critical material and time in concrete construction. We welcome job inquiries by letter, wire or telephone

Des Moines, Iowa, Phone 4-3101 **ECONOMY FORMS CORP.** Fort Wayne, Ind., Harrison 2363

(Continued from page 136)

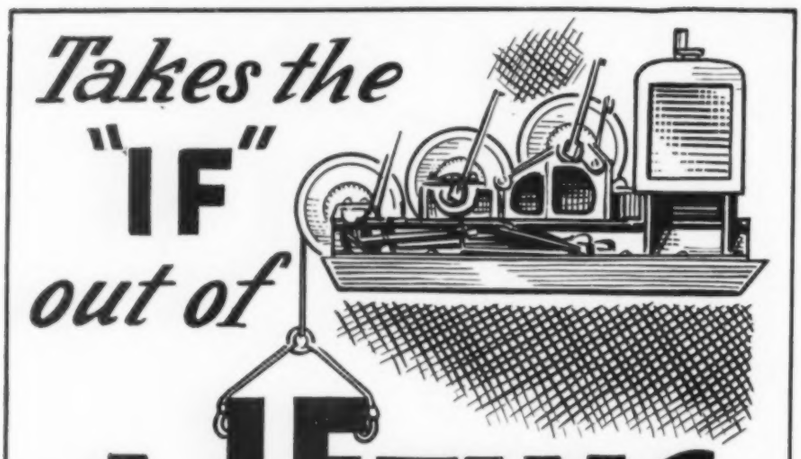
about 24 km. to a favorable point, and beyond this the second access road was constructed for 30 km. to Savonilla, a point on the location line of the highway. The organization and operation of a transport service over these access roads constitutes a considerable problem in itself.

Construction Problems

The construction has not presented any great difficulties beyond those to be expected in regions where previously little heavy or rapid construction has been carried on. True, the tropical forest is heavy in places and sometimes the jungle is thick. Dynamite is used freely to lift the huge trees, with their buttressed roots, and often as much as 120 lb. of explosive are used for a single tree. Some of the larger native oaks are 3 and 4 ft. in diameter at 50 to 70 ft. from the ground, are often free of branches for this height, and have a buttress circumference of 60 to 75 ft. Clearing to provide even a passable construction road is a major undertaking in many places through the Costa Rica mountains.

On the other hand, over long distances

(Continued on page 140)



Takes the "IF" out of LIFTING

There are a lot of mighty big IFs in every Lifting Job. IFs that can cost you time and money. "If this," "If that" . . . . they can all mean trouble IF you don't have the right equipment!

A Novo Hoist will eliminate most of these IFs. Novo Hoists are rugged, sturdy, and built to stand the gaff. They have ample power, and are job-designed and field-proven. Novo's complete Line of Hoists ranges from 1,000 to 8,000 lb. capacity. To take the IF out of your Lifting Job, get a Novo Hoist!

You don't need a "pull" to get the latest information on Novo Hoists. Just fill in the attached coupon.

Also a member of A.E.D.

Diaphragm and Pressure Pumps

Generator Sets

Hoists

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COUPON Send me complete information on the following types of Novo Hoists: Contractor___ Drag Line___ Mining___ Fertilizer___

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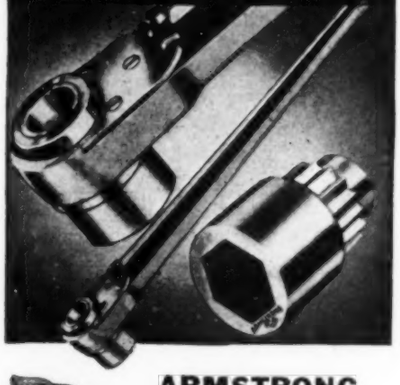
ARMSTRONG CONSTRUCTION TOOLS



ARMSTRONG DROP FORGED CONSTRUCTION RATCHETS

The ARMSTRONG Reversible Ratchet Construction Wrenches are made of steel thruout—the Ratchets are drop forged, the Nut Socket machined from special analysis bar steel. All parts except the handle are hardened. The spindle of the Ratchet is of "wide open" design—permits bolt to pass thru the Ratchet so that nuts can be run any distance along bolt and securely set with one setting. 24" or 36" Ratchets take square or hexagonal sockets for nuts of from 1" to 2 5/16" dia. or 1 1/16" to 3 1/16" dia., respectively.

Write for Catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
334 N. FRANCISCO AVE. CHICAGO, U.S.A.
Eastern Warehouse & Sales: 199 Lafayette St., New York

Wire Rope

Wire Rope plays a vital part in the fighting power of every soldier.
— Lt. Col. Roswell P. Rosengren

Demands (for Wire Rope) are increasing at a greater rate than production.
— *Steel*

Let's Make It Last — *to the Limit*

Unless you give your wire rope a fair chance, it will not give you the full service of which it is actually capable. The following suggestions should be helpful.

1

Use wire rope of the correct size, construction, type and grade for the particular work to be done.

2

Keep your wire rope using equipment in good condition. Sheaves should be of proper size, design, material—and free from corrugations. Keep all sheaves and idlers properly lubricated and in line. Avoid excessive fleet angles.

3

Keep your wire rope thoroughly and correctly lubricated.

4

Avoid kinks and sudden jerks; avoid cross-winding on drums, and reverse bends if possible.

5

Make sure your wire ropes operate with an adequate factor of safety. If there is not a proper ratio between the strength of the rope and the maximum load to be handled, the rope may be overstressed—a condition no rope can long survive.

6

Reels and coils of wire rope should not be dropped from car or truck when being unloaded . . . If rope is not put into service when received, see that it is stored in a place protected from weather and free from acid fumes.

Help speed the day of Victory by getting the utmost service from your wire rope.

A. LESCHEN & SONS ROPE CO.

WIRE ROPE MAKERS — ESTABLISHED 1857

5909 KENNERLY AVENUE — ST. LOUIS, MISSOURI, U. S. A.

NEW YORK . . . 90 West Street
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HERCULES RED-STRAND WIRE ROPE

SAN FRANCISCO . . 520 Fourth Street
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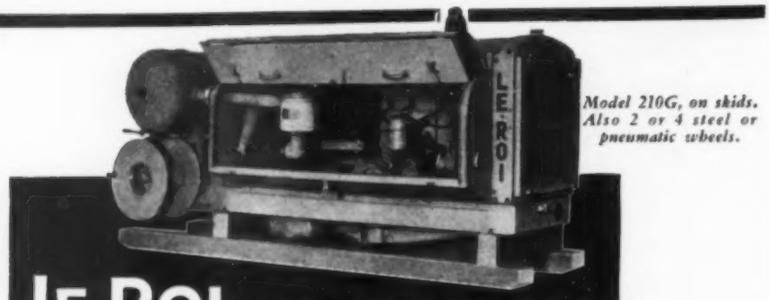


Model 210G, on skids. Also 2 or 4 steel or pneumatic wheels.

LE ROI COMPRESSOR

. . . THE ONLY ONE IN WHICH BOTH ENGINE AND COMPRESSOR ARE BUILT BY THE SAME MANUFACTURER

You enjoy smooth-running teamwork with Le Roi Compressors, Le Roi-powered. Dynamically balanced compressor crankshaft, drop-forged connecting rods, precision bearings, many other features assure you of performance that is a credit to your choice . . . See your Le Roi dealer for prompt, safe, satisfactory maintenance service. Ask about priorities on new compressors. C-21C

Le Roi Company
1712 S. 68th St., Milwaukee 14, Wis.

LE ROI

Cave-ins can be prevented!
SIMPLEX
Simplex Trench and Timber Braces, 18 to 60 inches long (in closed position).
DIES IN SEWER CAVE-IN.
Mishawaka, Ind., July 20 [Special] — Bert Wilson, 60 years old, father of five children and a resident of South Bend, was suffocated here today in a sewer cave-in
Here is real protection for crews against cave-ins and for contractors against re-digging. Only Simplex Trench and Timber Braces are constructed with drop forged balls, sockets and lever nuts. Unbreakable and more durable than malleable iron braces. The blunt safety lever nut also prevents accidents. Ask your equipment dealer.
Templeton, Kenly & Co., Chicago (44), Ill.
Better, Safer Construction Jacks Since 1899
Simplex
LEVER · SCREW · HYDRAULIC
Jacks
New 30 and 50-ton Simplex Hydraulic Jacks are helping to speed construction and engineering projects. Send for bulletin.

(Continued from page 138)

in Guatemala, Honduras, southern Nicaragua and northern Costa Rica, the growth is small and scattered and offers little difficulty to the clearing gangs.

The topography in the piedmont and mountain section is extremely irregular and is generally deeply dissected. Slopes up to 45 deg. are common and 60-deg. natural slopes are found. In rock there are, of course, the characteristic precipices of a volcanic formation. The resulting cuts and fills are short and heavy. Some cuts will run to 25 or 30 m. and fills to 35 or 40 m. on the down-hill sides. Quantities are above anything previously developed on highway construction by the engineers on the work, many of whom have had wide experience in the Rocky Mountain area and in the High Sierras. There are 44 km. between El Empalme and Angostura, along the crest of the continental divide, that average more than 38,000 cu. m. per km. Following this section the drop into El General Valley for 27 km. runs over 150,000 cu. m. average and one km. is above 366,000 cu. m. There are about 2,000,000 yd. of rock.

Soils Encountered

Much of the soil in the flatter country is very unstable and some in the mountains is certainly going to give trouble before it stabilizes in the higher fills. It is general practice to step the base of the fill out as far as possible to provide a bench that will present some resistance to movement when the rainy season is on. Over most of the fills the down side slope is "spot sodded" so that a heavy grass mat may be secured as soon as possible. The tropical grasses available produce a good cover likely to resist erosion and hold the surface once they have had a chance to develop.

The bad soils that are found in the volcanic plains consist generally of volcanic ash that takes up water like a sponge and produces a soft mud that is 2 or 3 ft. deep. It can stall an Army jeep. Another poor soil in the flat country is known as "sonsocuite," an Indian name. It has the consistency, when wet, of liver and looks not unlike it when sliced. It is entirely unusable when exposed on fills. It occurs over large areas in northern Nicaragua between Sebaco and Esteli, and in southern Nicaragua north of Rivas. When fairly dry it can be worked and acts not unlike California gumbo, but it must be blanketed with about 12 to 18 in. of good material ranging from sandy clay to loam in order to make it hold surfacing material. No stabilizing process involving any method of mixing has been tried because of the impossibility of breaking up the sonsocuite in order to mix it with a sta-

(Continued on page 142)

THE THUMB THAT "HITCH-HIKED" ITS WAY TO THE FRONT

Because of their proved ability to give better performance on tough assignments, Thermoid Products have been called "the products with a thumb" . . . that thumb which Aristotle cited as the symbol of man's superiority.

Today, a host of Thermoid Products are helping speed the super-tasks of war. And we are proud, indeed, that so many have "hitch-hiked" their way to the front as trusted components of vital materiel.

In sending us this striking photograph of its Thermoid-equipped units under fire, the LaPlant-Choate Manufacturing Co. says:

"In a matter of minutes after the 'all clear' signal sounds, these sturdy bulldozer and scraper units developed by LaPlant-Choate engineers will have the airfield levelled off and ready for service again. Small enough to be flown anywhere, these rugged outfits are used by the U. S. Airborne Engineers for repairing airfields, building vital supply routes, establishing new 'Shangri-las' and performing countless other chores important to Victory."

Thermoid Products are *designed* for unusual service—and *built* to deliver that service to *you*. It's good business to do business with Thermoid.

THE THERMOID LINE INCLUDES: Transmission Belting • F.H.P. and Multiple V-Belts and Drives • Conveyor Belting • Elevator Belting • Sheet Packings • Wrapped and Molded Hose • Industrial Brake Linings and Friction Products • Molded Hard Rubber and Plastic Products.

★

Don't put it off 'til tomorrow—
BUY MORE WAR BONDS TODAY!

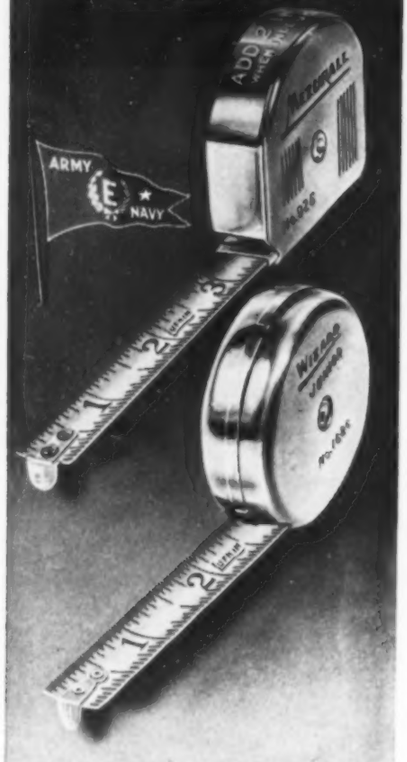
IT'S GOOD BUSINESS TO DO BUSINESS WITH THERMOID

Thermoid Rubber

DIVISION OF THERMOID CO.
TRENTON, NEW JERSEY

LUFKIN

TAPE RULES THAT EVERY ENGINEER SHOULD HAVE



Every busy engineer needs a Lufkin Mezurall or Wizard Jr. steel tape rule for his vest pocket—where it's handy and ready for those dozens of little measuring jobs that come up every day.

Ideal for general measuring work—inside, outside, height or depth. They're accurate for both hook or butt end measurements. Six feet long, they remain rigid when extended yet will wrap around corners or curves with ease. Write for free catalog.

BUY THROUGH YOUR DISTRIBUTOR

LUFKIN

SAGINAW, MICHIGAN • New York City

TAPES • RULES • PRECISION TOOLS

(Continued from page 140)

bilizing material. On a large scale such a process would almost certainly be a failure.

Fortunately, little lowland swamp is encountered anywhere along the entire line. But in the mountains there are some troublesome areas of upland swamp caused by submerged rock dikes, the result of some previous volcanic uplift, that impound the ground water plentifully supplied, especially at the highest elevations, by the torrential rains of the wet season. It is necessary to locate these ridges and blast a channel that will permit the basin to drain, remove most of the unstable and decomposed material that has accumulated over the years, and refill the excavations.

Drainage Structures and Bridges

Drainage structures present some interesting practices, resulting in part from the rapidity of the construction, from the program of construction which involves a pioneer, low-standard road to be followed by the standard construction at a later date, and from the fact that masonry is a familiar form of building in Latin America, with plenty of good masons available.

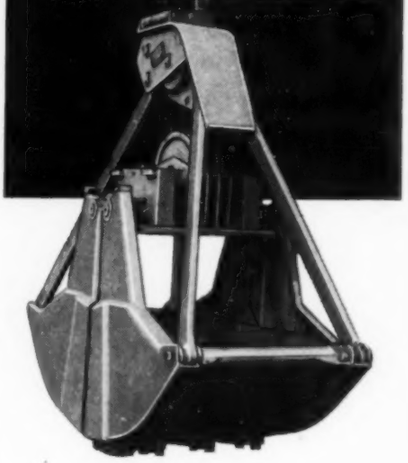
The width of the pioneer road permits the installation of short pipe and box culverts. These can be later extended to fit the width of the standard road. With this in mind, headwalls and wingwalls are omitted on the initial structures and riprap is used to protect the inflow ends. The outfall ends are carried out far enough to save the slopes from undercutting.

The allotments of steel for the project have not permitted complete construction of all truss and other steel spans planned. The selection of locations for initial installation of steel spans was made on the basis of hazard. Where the streams were so large or torrential in the rainy season as to make it probable that a temporary structure would go out, a permanent span was decided upon. Where the final steel cannot be placed, temporary wooden spans are being used. Where these structures are so large as to require expensive or especially heavy substructures, the temporary spans are set off line and down stream. If they fail, and some will certainly do so in the rainy season, their failure will not jeopardize the permanent structure that may be under construction at the time. The use of green lumber, which alone is obtainable in quantity in most of Central America, has been avoided by having a large number of standardized wooden trusses of 50-, 75-, and 100-ft. spans fabricated and matched in the States, and then shipped like fabricated steel to be erected where needed.

Culverts of box or arch type up to 20-

(Continued on page 144)

New JOHNSON all-Welded BUCKETS



New and exclusive Johnson features give this new streamlined bucket efficiency-promoting and life-prolonging advantages in all centers of action.

Needle Bearings Sealed Against Dirt

All-Welded Construction Reduces Digging Resistance

Its all-welded construction eliminates power-wasting bolts and rivets . . . provides greater stability through proper weight distribution.

A renewable lip edge bar, of durable manganese steel, gives greater digging efficiency and many times the life of the ordinary steel lip construction.

Renewable Manganese Steel Lip Edge

Large Diameter Sheaves Increase Rope Life

Guide sheaves replace conventional cross-rollers . . . greatly reducing cable wear. Needle bearings (protected against dirt by special synthetic rubber seals) are used on all closing sheaves.

General Purpose Type (⅛ to 2 yard capacity) in stock for immediate delivery to U. S. and Canadian contractors with required Government authorization. The line also includes Rehandling Buckets ½ to 2½ yards, Heavy Digging ½ to 1½ yards.

Get Data on Johnson Bins —Batchers— Ready-Mix Plants

The C. S. Johnson Company

Champaign, Illinois

LIFTING MACHINERY is only one of many Porto-Power uses. Simple attachments "harness" the hydraulic ram for "toe lift." Other combinations serve push, pull, bend, clamp and press jobs—over any span—any angle!
NOTE: TOE LIFT
Porto-Power
HELPS YOU STAMP OUT
CROWBAR-ITIS
WHY WASTE VALUABLE MANPOWER? Porto-Power raises a machine more quickly — more safely — with fewer men than are used where "crowbar-itis" reigns! Watch other crude, time-wasting practices disappear, too, when Porto-Power is at your service!

WHEN you see a crowbar in the sweaty grasp of men . . . *investigate!* It may be a bad case of "crowbar-itis," reaping its toll of wasted man-hours and costly damage.

"Crowbar-itis" is the malpractice of using a crowbar on jobs that could be handled more efficiently by Porto-Power.

Porto-Power is a *hydraulic* device that boosts the power of one man *up to one thousand times.* It's *controlled* power, too!

It replaces dangerous, damaging, time-wasting methods and does 1001 maintenance, production and construction jobs faster, more easily, with fewer men, greater safety and without damage to machinery.

Porto-Power is war-power today! It is available through your Blackhawk Industrial Distributor in 7, 10, 20 and 50 ton capacities. Call him — or write us today for literature.

A Product of

BLACKHAWK MFG. COMPANY

Department P2324 • Milwaukee 1, Wisconsin

BLACKHAWK

BLACKHAWK MFG. CO.
Dept. P2324, Milwaukee 1, Wis.
Please rush Blackhawk Hydraulic Equipment Bulletin V-43.

Name.....

Firm.....

Address.....

(Continued from page 142)

ft. span are generally constructed with rubble masonry abutment walls and wings. Reinforced concrete decks are used generally but if clearance is sufficient arches of selected rubble stone are built. A roughly coursed rubble was developed that is rapidly placed, and once the local mason foremen caught the idea the work was well done and presents a pleasing appearance.

The outline of the abutment wall and wing is laid out, staked, and lined with string. Rubble stone with a flat face is selected and laid to line on the base. The height of stone is not important, but headers and stretchers are used in proper proportion. The area between the outline stones is filled with rubble with irregularly scattered long stones set on end. The whole course then is filled with mortar with small stones fitted into the top joints as fillers. The surface is given a general leveling which leaves the key stones standing in a roughly set course. The lines are raised and another course placed in the same way, carried entirely from out-to-out of wings. This kind of work proceeds with astonishing rapidity.

On some of the larger bridges cut stone facing is used. The stone is dressed on

(Continued on page 146)

Compactly designed to work fast in close quarters and ruggedly built to assure low-cost, dependable performance, Insley Excavators are demonstrating their value to the army engineers and seabees in many ways on many fronts. That's why all Insley production is now ear-marked for front-line duty.

But when this war is won, there'll be plenty of Insley equipment for your jobs. When the day comes, we believe you'll agree with the men of our armed forces who are today learning that Insley equipment does the job right . . . *and right now!*

EXCAVATORS • CRANES • BUCKETS • CARTS
INSLEY
CONCRETE PLACING EQUIPMENT

INSLEY MANUFACTURING CORPORATION
INDIANAPOLIS 1, INDIANA

UNION

EST. 1900
Union Iron Works, Inc.
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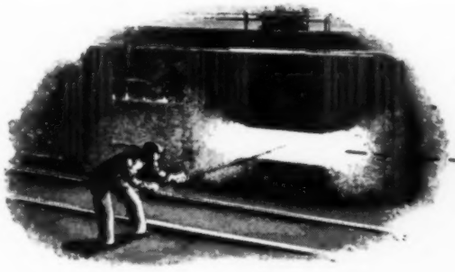
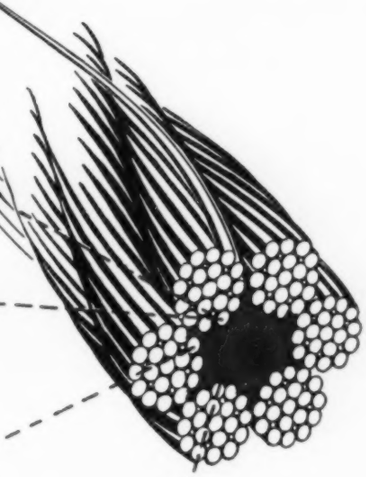
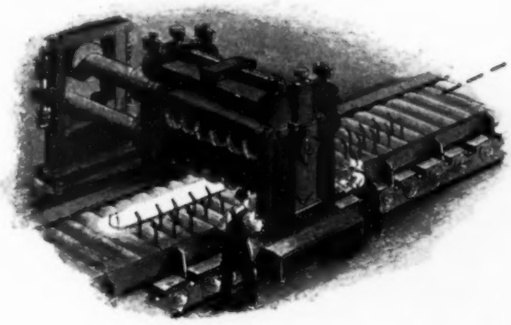
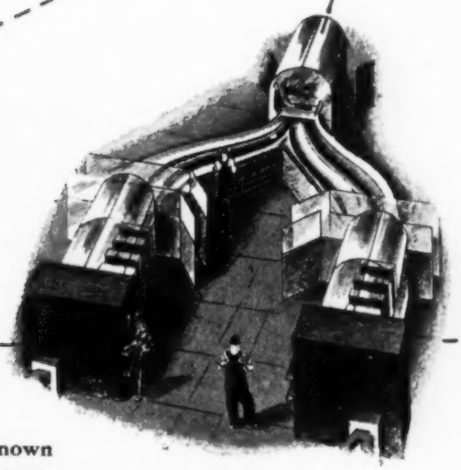
Open hearths, blooming mills, rod and wire mills, all aimed in one direction... the production of specialized wire ...the best we can make...

ROEBLING "Blue Center" STEEL WIRE ROPE









WHAT can you expect from Roebling? Rope that has known capacity to deliver service. Engineering, in our plant and at your job, to put the rope to work right. Maintenance practices that protect its long life » » Your postwar profits and postwar jobs will depend in part on operating rope-rigged equipment at lowest cost. You can leave that part to Roebling.

JOHN A. ROEBLING'S SONS COMPANY
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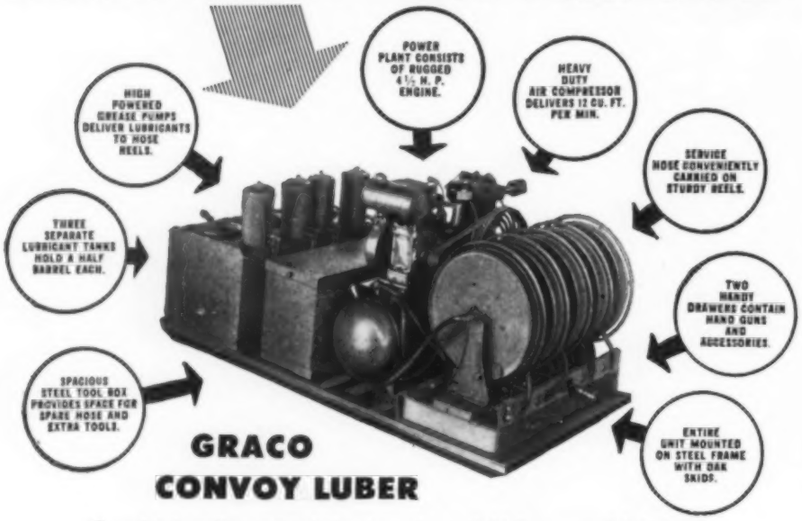
PACEMAKER IN WIRE PRODUCTS

Wire Rope and Strand • Fittings • Cold Rolled Strip • Aircord, Swaged Terminals and Assemblies • Round and Shaped Wire Wire Cloth and Netting • High and Low Carbon Acid and Basic Open Hearth Steels Suspension Bridges and Cables • Electrical Wires and Cables • Aerial Wire Rope Systems

LUBRICATE "ON-THE-JOB"


POWER PLANT CONSISTS OF RUGGED 4½ H. P. ENGINE.
HEAVY DUTY AIR COMPRESSOR DELIVERS 12 CU. FT. PER MIN.
HIGH POWERED GREASE PUMPS DELIVER LUBRICANTS TO HOSE REELS.
SERVICE HOSE CONVENIENTLY CARRIED ON STURDY REELS.
THREE SEPARATE LUBRICANT TANKS HOLD A HALF BARREL EACH.
TWO HANDY DRAWERS CONTAIN HAND GUNS AND ACCESSORIES.
SPACIOUS STEEL TOOL BOX PROVIDES SPACE FOR SPARE HOSE AND EXTRA TOOLS.
ENTIRE UNIT MOUNTED ON STEEL FRAME WITH OAK SKIDS.

GRACO CONVOY LUBER

Completely self-contained, the air powered Graco Convoy Luber dispenses chassis, track, gear or hypoid lube through 30 ft. reel mounted hoses. High speed construction demands high pressure lubricating. Modernize your equipment lubricating methods with a Graco Convoy Luber. Write for descriptive new catalog No. 136.

GRACO

GRAY COMPANY, INC.

MINNEAPOLIS • MINNESOTA

ARMY E NAVY

★★ Immediate delivery on Gasoline Powered 1½ H.P., and wheelbarrow or round base mounted 3 H.P. units on suitable priority.

BACK THE ATTACK BUY WAR BONDS

3 H.P. Gasoline Powered Unit Placing a Stiff Mix Concrete

Contractors—make the most of time, men and materials, get a stronger, better watertight job, and eliminate power line installation costs and worries with a MALL Gasoline Powered Vibrator.

These units are easily moved anywhere on the job by one man, operate all day on 1½ to 2 gallons of gasoline, start quickly in all temperatures, and require little attention. In addition, the variable speed gasoline engine supplies abundant power for 8 other interchangeable tools.

These advantages plus many others make MALL VIBRATORS indispensable to handle Wartime work and to meet post-war competition. Write at once for full details. You'll be money ahead with a MALL Vibrator.

MALL TOOL COMPANY

7757 SOUTH CHICAGO AVE., CHICAGO 19, ILLINOIS

Offices and Distributors in Principal Cities

(Continued from page 144)

all matched joints and face and the backs left rough. The depth of the blocks is from 12 to 18 in. These gravity stones are set in courses and built up five or six high. The cyclopean concrete core is then placed with a liberal scattering of one man stone collected generally from the river and sledged. This practice entirely eliminates forms and the gravity face stone is a guarantee against serious damage from heavy drift or rolling boulders during flood stage of the streams.

No Soil Stabilization

It has been quite impossible to attempt any soil stabilization, as such, owing to the cost and time required. Failure of subgrade material will have to be taken care of by generous surface maintenance. The present plan is to make soil studies sufficient to determine the general location of good and bad materials and to stock-pile gravel or fine crushed stone for surface maintenance, stocking generously where poor base is located, and using smaller quantities where the subgrades are better. In a few favored areas where volcanic sands constitute a fair proportion of the subgrade, no special preparations for more than limited surface maintenance need be made. In this way it is expected that the surface can be kept intact in spite of base failures by use of the maintenance material provided along the roadway.

Camp Sanitation

The maintenance of large construction camps and the employment as machine operators of many North Americans who have had little experience in the tropics necessitate special attention in the sanitary care of camps, kitchens and mess houses and the provision of assured potable waters and a certain amount of preventive medicine. All camp quarters are screened, hot baths are provided, drinking water is boiled, chlorinated or ozone treated, and malaria is combated with prophylactic doses of atebrine given in tablet form in the mess houses at meal time.

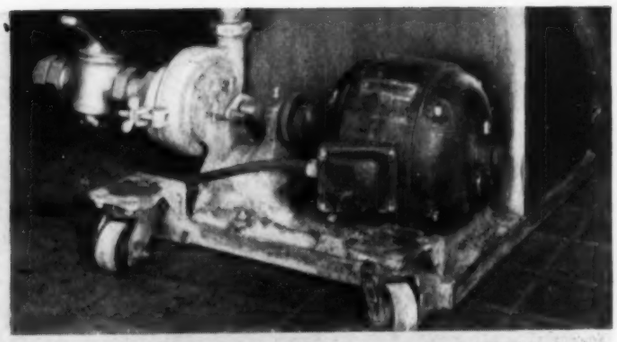
Hospital quarters are provided where needed, and either local or American doctors are in attendance. At one camp a 24-bed hospital is in use, and as the locality was a bad malaria focus, it was for a time well filled. The use of atebrine has, however, reduced the number of cases to an encouraging degree.

Types of Equipment

No special equipment is used. In fact, the reverse is rather the case, for it has not been possible always to obtain spare parts as needed and makeshift repairs have been in order. Good repair shops

(Continued on page 148)

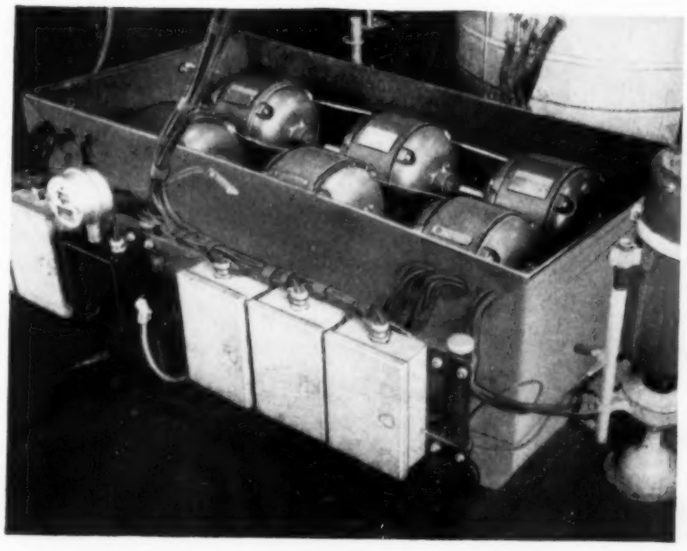
DOUSED DAILY!



G-E Tri-Clad motor coupled to a centrifugal pump on a portable cleaner in the milk plant of H. P. Hood & Sons, Inc., Charlestown, Mass.

POWERING A DAIRY PUMP, this Tri-Clad splash-proof motor gets a dousing every day as the plant is hosed down. After years of service, frame and end shields are virtually uncorroded, insulation is going strong. G-E "protection tests", both in the development of the Tri-Clad design and in our daily production, help us assure you of long-lasting service from Tri-Clads on motor-wracking jobs like this.

"Hot Box" at 100% humidity tests TRI CLAD motor protection



Here is one of the many development tests which helped to prove the *extra* stamina engineered into the Tri-Clad design. In the bottom of this moisture box, just below the motor base, two inches of water was maintained at 212 F. The cover kept the humidity within the box at 100 per cent. By operating motors in this atmosphere to the breakdown point, G. E. got the low-down on the coil insulation's moisture resistance. Tri-Clad motors, in both open and splashproof construction, showed up unusually well in this extra-severe test. *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

Every week more than 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

A
GRIFFIN
WELLPOINT
JOB

Want a

DRY JOB?

NO WATER PROBLEMS — NO SHEETING — NO DELAY for the J. C. Truman Construction Co. of El Dorado, Kansas, on this difficult river crossing. A 24 inch gas line was firmly anchored and buried at depths of 10 to 32 feet. The Griffin Wellpoint System drained up to 9,000,000 Gallons per day permitting job progress in DRY excavation all around the clock. CALL GRIFFIN for these results on your next wet job.

MID-WEST
GRIFFIN ENGINEERING CORP.
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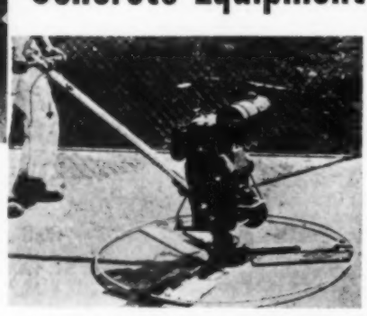
GRIFFIN ENGINEERING CORP.
633 N. Myrtle Ave. · Jacksonville 5-4516
JACKSONVILLE, 4, FLA.

Main Office: 881 EAST 141st STREET, NEW YORK 54, N. Y.
GRIFFIN WELLPOINT CORPORATION

Whiteman
MECHANIZED
Concrete Equipment



Modern concrete slab construction calls for Whiteman machines. For SCREEDING use the Whiteman Rodding Machine — one operator handles 4 cu. yds. of low slump mix in 5 minutes. The power-operated screeds simultaneously level and compact the concrete.

Three other Whiteman time and money savers: Whiteman Screed Stake Caps; Whiteman Screed Stakes — both newly designed for form construction; and the Whiteman Hand Grill Tamper — indispensable on small jobs.

For FLOATING and FINISHING use the Whiteman dual-purpose Finishing Machine. One man can float or finish 1,000 sq. ft. in as little as 15 minutes.

For further information see your nearest distributor or write direct to:

Whiteman MANUFACTURING CO.
3249 Casitas Avenue — Los Angeles 26, California

(Continued from page 146)

are maintained because the rapid heavy work is hard on the best of machinery.

Diesel rather than gas equipment is used, especially in the higher altitudes, to reduce the loss of power. It was first thought that lighter equipment models would be an advantage in the mountains because of their greater flexibility. This opinion was in a measure due to the original plan to attempt to build to narrow pioneer standards, but the difficulties promised in later widening operations were so great, that it was decided that in the most difficult mountains the initial construction should be to full width, and it followed that heavy equipment both in tractors and carryalls would under the circumstances be more economical. The loss of power in the highest altitudes by tractors of low horsepower would have made them useless for fast heavy work.

★ ★ ★

Stabilized Shoulders

(Continued from page 59)

contracted for and completed on the 40.5-mi. section of trunk highways No. 10 and 371 between Royalton and Brainerd.

Construction details were worked out by the district maintenance engineer, guided by the district soils engineer and the central office laboratory. In general, it was planned to vary specifications to allow use of material from pits located within economical hauling distances of sub-sections of the project; consequently, three gravel and three binder-soil pits were selected.

Pit Operations

Gradation and mix requirements were established for each pit. Specifications required the stripping of top soils to required depth, the leveling of gravel pit areas, and the depositing of a specified layer of binder soil over the prepared gravel bed. The material was then loaded from a vertical face and passed through the crusher for mixing and reduction to maximum ¾-in. size. The bottom of the excavation plane was checked frequently to maintain established proportions.

Due to irregular depths and boundaries of gravel deposit, the operations were

Continued on page 150)

AVOID ANOTHER WPA... Plan Now

You'll Make Tax Money Go Further and Assure Better Pay to Workers If You Plan to Use Modern Cost-Cutting Rigs On Your Highway Rebuilding, Relocation and Widening Projects

"I don't think you want another WPA after the war. I don't think you want social workers to come around and investigate your need for a job. I don't think you want to have to pass a 'means test', and I don't think you want to work again for mere relief wages. But unless we plan more wisely than we did before, another WPA, or something very much like it, is exactly what you may expect."

—Major General Philip B. Fleming, Administrator, Federal Works Agency.

You can help save your State or County from the relief wages and the slow, costly construction of WPA by pushing local highway plans to the bidding stage. Urge your State and County to get definite plans completed NOW so actual construction work can begin as soon as war ends.

Plan to Save

Base your estimates on the use of modern equipment. Rebuilding, relocating and widening today's highways definitely calls for longer hauls. You can save on such long hauls by figuring to use the rubber-tired power and speed of Tournapulls.

Protect Present Surface

The big, pneumatic tires of Tournapulls enable you to haul over existing roadways with little or no damage to the surface. Result: You move bigger loads faster, require fewer rigs for a given yardage, thus interfere less with traffic. And more of the present surface is left ready for incorporation into the new system.

Save on Loading and Spreading

You save, too, on loading. One pusher easily handles 3 or 4 Tournapulls, depending on length of haul . . . so your low initial investment in a flexible, multiple-purpose pusher tractor is spread over 30 to 50 loads hourly. Compare Tournapull loading costs with shovel or elevating grader costs.

What's more, Tournapulls spread their own loads, require no investment in spreading tools . . . and in traveling back and forth over the fill they add substantially to compaction.

Do It NOW

All these benefits can be yours with the rubber-tired power of Tournapulls. But neither you nor we will be able to use such modern power, if plans aren't ready to take up the slack in unemployment the day war ends. Complete your plans NOW.

(Above) Two of a fleet of six Tournapulls operating over pavement. Big tires protect the surface, same time permit faster hauling and larger loads.

This Tournapull speeding an airbase in North Africa is just one of several hundred helping to end the war. The experience gained here and on other war projects from the Aleutians to Australia will make the postwar Tournapull ever better than the 1300 already in use.

TOURNEAU TOURNAPULLS

PEORIA, ILL. STOCKTON, CALIFORNIA

Trade Mark Reg. U. S. Pat. Off.

RUBBER-TIRED POWER FOR FASTER EARTH MOVING

MATERIALS HANDLING & PROCESSING EQUIPMENT

WHEEL TRACTOR CRANES
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TRAILER TRUCKS

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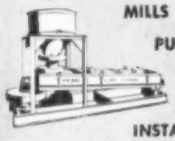
CONVEYORS
CARTS & TOOL WAGONS
ELEVATORS

GYRO SIFTERS
CRUSHERS

CUTTERS
MILLS & MIXERS

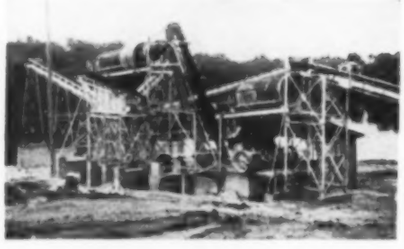


PULVERIZERS
GRINDERS
COMPLETE INSTALLATIONS

The handling equipment construction "know-how" of the Mercer Engineering Works, Inc., Clifton, N. J. . . . The more than 40 years processing equipment experience of Robinson Mfg. Co., Muncy, Pa. . . . All are embodied in and represented by

MERCER-ROBINSON COMPANY, INC.
INQUIRIES INVITED
30 CHURCH ST., NEW YORK 7, N. Y.

Reliance *is Ready for the End of the War*



RELIANCE PRODUCTS

Rock Crushers, Bucket Elevators, Revolving Screens, Storage Bins, Pulverizers, Chip Spreaders, Heating Kettles, Bin Gates, Feeders, Belt Conveyors, Grizzlies, Air Separators, Sand & Gravel Spreaders, Wash Boxes.

RELIANCE Washing-Screen Plants, Crushers, and Conveyors are being installed on the global war fronts and at training stations elsewhere. The photo shows one set up on a river bank—"somewhere in South America".

The rugged construction of RELIANCE equipment amply fits it for RUSH War work. The same equipment will soon be available, we hope, for construction at home.

Advise us what your plans for Post-War work will require. Tell us the type, size and amount of washing, screening, crushing and conveying equipment, which you are likely to need. Then we can prepare intelligently to help you meet Post-War demands, which may come suddenly. *Write to-day.*

UNIVERSAL ROAD MACHINERY CO.
Kingston, N. Y., U. S. A.
DISTRIBUTORS IN ALL PRINCIPAL CITIES OF U.S.A.

(Continued from page 148)

changed in one pit and gravel and binder soils hauled to a convenient stockpile in proper proportions for loading, mixing and crushing. Prepared pit or stockpile areas were kept comparatively dry by covering with tarpaulins and paper.

Shoulders were constructed to a 3-ft. width and a uniform depth of 4-in., with 1/3 in. per foot of slope. Earth shoulders were trenched to specified dimensions with a motor grader equipped with adjustable template cutting edge. Mixed material was deposited in two succeeding 2-in. layers by use of a spreader box, then watered and rolled. All operations were under the close supervision of a pit and on-the-road inspector. Final shaping and finishing were done by motor grader. All trenched material was placed on the slopes and spread uniformly by motor grader, except through some approaches and intersections.

The work was done by contract with the Ashworth-Hawkinson Co., of St. Louis Park, Minn., on a low bid of 19½ c. per sq. yd. in place. Total quantity was approximately 160,000 sq. yd., requiring a total of 46.8 working days of 8 hr. each.

Surface treatment with calcium chloride, at the rate of 1 lb. per sq. yd., by the Maintenance Division, followed the contract work. Two additional calcium chloride applications at the rate of ¾ lb. per sq. yd. were provided in the maintenance schedule. The calcium chloride treatments are serving economically to prevent or arrest the loss of the fine binder soils. Only a small amount of ravelling of the coarser aggregate has occurred. Pavement-edge rutting and wear is being corrected periodically by blading, since the stabilized mat is kept in a sufficiently damp state by the calcium chloride to permit these operations even during prolonged dry periods.

★ ★ ★

Women Workers

(Continued from page 60)

to standard or slightly better than usual condition.

The women employees are selected with care and with a view to physical fitness. Before going into the field, all are given careful instruction and during this training period are paid the apprentice rate. When they take over regular duties they are paid the same rate as men get for corresponding service. Training schools were established during 1943 at four state highway division points where

(Continued on page 153)

They practice what they preach

Here in the oil fields, operators talk and produce in terms of thousands of barrels. But when it comes to consumption of these vital stores of petroleum—then these same men are just like any "A" book holder down to his last coupon.

This vigilance against waste is not just a war expediency. It began long before the hooked cross spread its tentacles over the world . . . and its beginning was marked by the introduction of Cummins Diesel Power in the oil fields because it was found to be "Faster and Cheaper than Steam."

Today, in every major producing area, Cummins Dependable Diesels are in the forefront of the petroleum industry's fight to achieve maximum production with maximum economy . . . not only economy in the consumption of fuels and lubricants, but also economy of time, materials and manpower.

Here, truly, is a demonstration of conservation . . . here is an example of men in industry who *practice what they preach!*
CUMMINS ENGINE COMPANY, Columbus, Indiana.

This is the fourth in a series of advertisements depicting the war-time role of Cummins Diesel Power in the nation's basic industries. If you are operating Cummins Dependable Diesels, you can assure their most effective use by making doubly sure that they are maintained and serviced—regularly and efficiently. Ask your Cummins Dealer for details.

HOW MANY OF THESE POST-WAR MILES WILL YOU BUILD?

The answer is right in your own hands

THE number of post-war miles you'll build depends largely on how well you do two things *right now!* **First**—talk up the need and advantages of prompt action on post-war highway construction programs among influential members of the communities you cover. **Second**—plan an organization and equipment set-up that assures you a competitive advantage when these jobs open up and bidding starts. Let your Lorain distributor act as right-hand man when planning your post-war equipment. He'll give you the last-minute information on the type of equipment needed to handle jobs scheduled for your area on the most efficient, economical basis. If you haven't done so already, start things moving by getting in touch with your nearest Lorain distributor today.

THE THEW SHOVEL COMPANY • LORAIN, OHIO

ESTIMATE OF NEEDED POST-WAR CONSTRUCTION ON FEDERAL AID AND STATE HIGHWAYS—38 STATES

State	*Estimated Total Cost Roads and Bridges*
Alabama	$ 57,532,000
Arizona	48,450,000
Arkansas	133,663,000
California	168,790,000
Colorado	78,504,000
Connecticut	243,300,000
Florida	115,843,000
Georgia	92,928,000
Idaho	23,760,000
Illinois	183,155,000
Indiana	160,861,000
Iowa	182,420,000
Kentucky	75,522,046
Louisiana	148,000,000
Maryland	86,146,000
Massachusetts	121,000,000
Michigan	340,009,000
Mississippi	77,278,500
Missouri	41,384,000
Nebraska	66,450,000
Nevada	38,049,370
New Jersey	193,590,000
New York	540,000,000
North Carolina	75,700,000
Ohio	580,000,000
Oklahoma	135,000,000
Oregon	150,000,000
Pennsylvania	449,768,000
Rhode Island	16,280,000
South Carolina	57,500,000
Tennessee	150,000,000
Texas	830,000,000
Utah	54,100,000
Virginia	110,753,000
Washington	65,200,000
West Virginia	179,300,000
Wisconsin	153,000,000
Wyoming	16,500,000
Totals	$6,215,975,916

(Figures Prepared by American Association of State Highway Officials)

thew Lorain SHOVELS

CRANES • DRAGLINES • MOTO-CRANES

(Continued from page 150)

demonstrations could be given with regular equipment by an instructor specially qualified for this work. In most cases the instruction could be completed in a few days and consisted largely in practice in shifting gears and in backing. Even women who had had long experience as automobile drivers needed practice in backing trucks which were mostly of 2- and 3-ton capacity in the crews on which women were employed.

R. H. Baldock is chief engineer of the Oregon State Highway Commission.

★ ★ ★

Concrete Paving Job Uses Air-Entraining Cement

(Continued from page 85)

tendency which has to be watched when concrete containing air-entraining cement is mixed beyond 60 sec. The resulting concrete, made with slag aggregate, exhibited the plastic, cohesive quality, freedom from bleeding, and buttery character generally typical of mixtures containing air-entraining cement.

Of more immediate importance to the contractor, the air-entraining cement produced a concrete which was almost free from surface bleeding, thus providing little water for lubrication during finishing. It was necessary to finish the concrete promptly, before the surface would become too dry, and this fact caused the finishers to work closely behind the mixer, avoiding long overtime at the end of the day and permitting the curing compound to be applied early to the slab. Prompt finishing was of particular advantage in the cool fall days.

Joint Installation

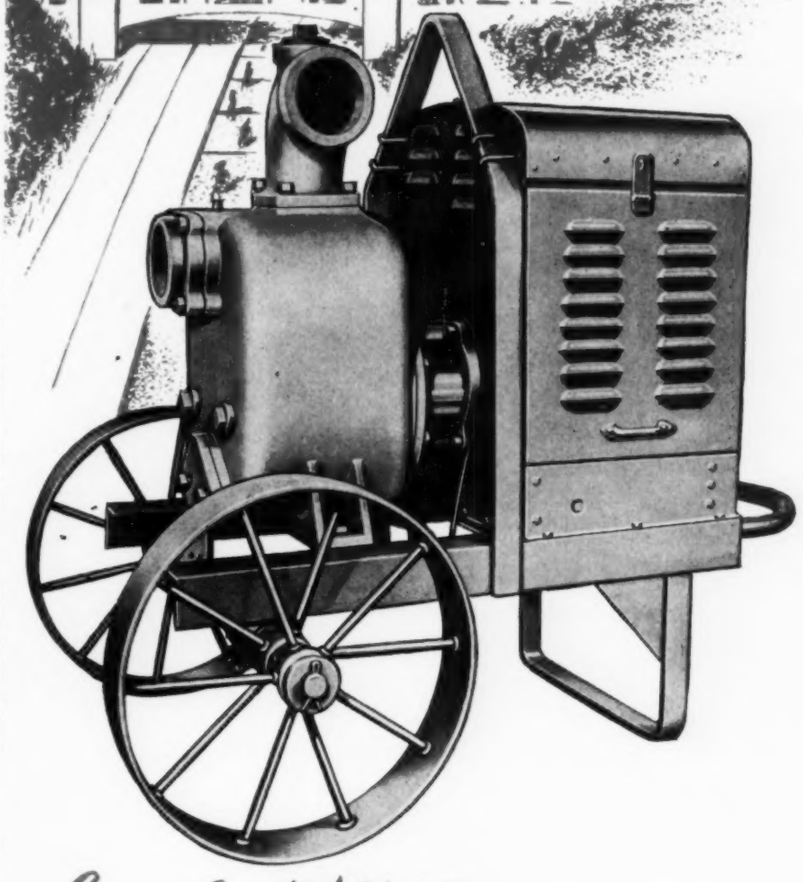
Transverse expansion joints of 1-in.-thick asphalt-impregnated Celotex were installed without dowels, flush with the pavement surface, at 120-ft. spacing. Between the expansion joints, transverse contraction joints on 20-ft. centers were cut 3 in. deep by the joint machine and were filled with ⅛-in. premolded paper filler. To set the flush joints accurately, the contractor employed templates of a type which the firm's master mechanic has been building for years.

Specifications required 75-sec. mixing

(Continued on page 154)

in the foreground of tomorrow's

Highway Construction Picture...



Low Cost Water - by Carver

• No figures are handy on how many gallons of water have to be moved per mile of highway built, but any roadbuilder can tell you it's plenty. That's why—on tomorrow's competitive, closely-bid highway jobs—you'll find the savings you can make with CARVER *Certified* Centrifugals mighty important items of profit.

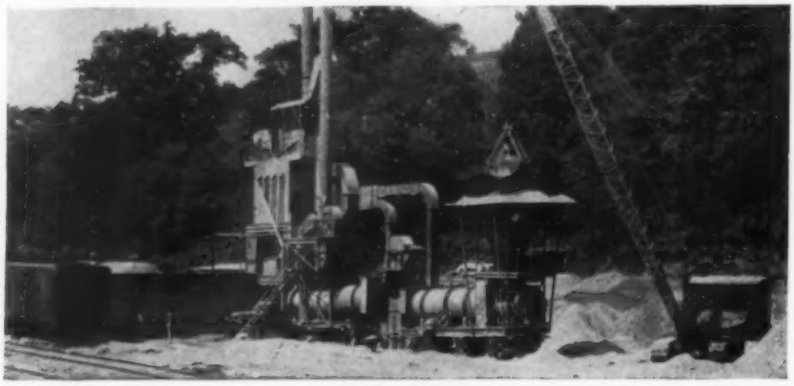
From every standpoint—first cost, operating expense, downtime and repairs, and length of useful life—CARVERS cut pumping costs. Fast-priming, efficient, non-clogging and simply designed with extra strength and life in every part, CARVERS get to work faster, stay on the job longer and *get more done!*

Your nearby CARVER distributor will gladly furnish the facts . . . see him soon.

THE CARVER PUMP CO.
Muscatine, Iowa

CARVER CENTRIFUGAL *Certified* PUMPS

2 Big Airport Paving Jobs Completed in 1943—*Another Started*



With This H & B Portable Asphalt Plant

The portable asphalt plant shown above—one of four H & B plants owned by Allegheny Asphalt Paving Company of Pittsburgh—completed two airport jobs in 1943, and started on another. Total asphalt production on the two jobs was 87,600 tons, with an all-time average of 96 tons per hour, and the high production 132 tons per hour. The Allegheny Company's other portable plant—a smaller unit used as an auxiliary plant—completed one airport job in 1943 and started on another. Allegheny Company officials attribute these production records to the efficiency of the double driers, which permitted continuous operation. For many weeks the plants operated a total of 20 hours per day. Literature on H & B portable and stationary asphalt plants will be sent on request.

HETHERINGTON & BERNER Inc. • Indianapolis 7, Indiana

H&B Hetherington & Berner

IMPORTANT JOB INFORMATION in these

4 McGRAW-HILL BOOKS

1. *Cooper* — SUPERVISION OF GOVERNMENT EMPLOYEES

A handy manual of attitudes and methods for the supervisor, dealing particularly with the problems of civil service organizations. Starting with valuable suggestions to help the civil service employee secure promotion to a position entailing supervisory responsibilities, it covers in detail methods of leadership, and of selecting, training, and directing employees. Presents tested techniques and ideas recommended by experienced government supervisors. 202 pages, $1.75

2. *Barrows* — WATER POWER ENGINEERING

Sound and authoritative treatment of principals and practice underlying the design of hydroelectric power developments. Covers theoretical fundamentals and the complete water power project from investigation and estimate to plant design. Emphasis on descriptions of equipment, methods of design, data on costs, and other practical features make it an invaluable guide and reference for the engineer. Third Edition, 791 pages, $6.00

3. *Roark* — FORMULAS FOR STRESS AND STRAIN

A handbook for strength of materials bringing together all the formulas, facts, tables, and principles required in the more precise and accurate methods of stress analysis imposed by modern engineering trends. Complete background and refresher information for the designing engineer. Second Edition, 366 pages, $4.00

4. *Brady* — MATERIALS HANDBOOK

For engineers and executives, a ready reference book of pertinent and important facts relating to materials used in industrial manufacturing and processing, with information on their chief characteristics, comparative data, sources, substitutes, adulterants and uses. 6,650 materials are included in the new, revised Fifth Edition. Fifth Edition, 727 pages, $5.00

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Company CM-2-44

(Books sent on approval in U.S. and Canada only.)

(Continued from page 153)

time for a dual-drum paver, but the two batchmeters on the Ransome 34E mixer used by the contractor were set to give a total time of 80 sec. for each batch passing through the twin compartments. On this basis, the minimum theoretical cycle between discharge of successive batches by the dual-drum machine was 54 sec. Actual production was considerably less than the theoretical maximum, largely because of time lost in moving equipment, waiting for batch deliveries and other delays. Including lost time, the paver normally averaged 450 batches (600 cu.yd.) in a 10-hr. day. About one day a week was lost by bad weather, and the average weekly production was about 2,250 batches (3,000 cu.yd.), with high weeks running to 3,000 batches, (4,000 cu.yd.). On a good day, the paver averaged 52 batches an hour for the 10-hr. shift, including time consumed by delays. With allowance for overrun, which averaged 2 to 2½ percent, a 3,000-yd. day completed 1,760 lin.ft. of normal 12-ft. lane, 9-in. uniform thickness.

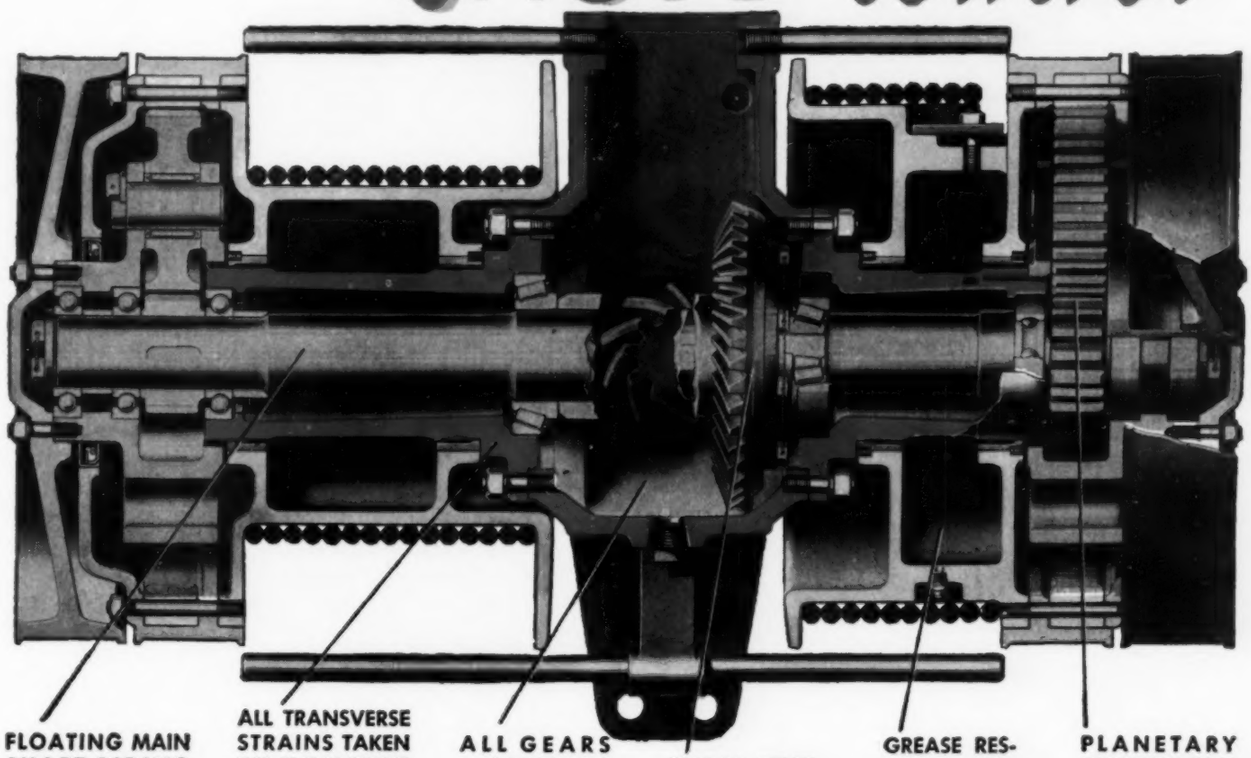
Meeting a cement requirement of 6 sacks per cu.yd., the 36-cu.ft. batch contained 8 sacks of air-entraining cement. Coarse aggregate was made up of two sizes of slag, No. 3 (100 percent passing 2-in. screen) and No. 4 (100 percent passing 1-in.). Average moisture content of the slag was about 1.5 percent for No. 3 and 2 percent for No. 4. The quantity of water added at the mixer never exceeded 42 gal. for an 8-sack batch. Actual weights of cement and aggregates for a typical batch were as follows: 752 lb. of cement, 1,780 lb. of sand, 1,028 lb. of No. 3 and 1,038 lb. of No. 4. With the maximum allowed additional water, this batch produced a concrete weighing 140 lb. per cu.ft. If standard portland cement had been used instead of air-entraining cement, the weights of various ingredients would have been greater, and the resulting concrete would have weighed about 144 lb. per cu.ft. Weight of the concrete was checked daily by weighing fixed-volume samples taken from the subgrade.

Fine Grade and Forms

Form needs on the job were amply filled by 10,000 lin.ft. of Heltzel military-type 9-in. forms. Compacted granular pavement base 12 in. deep was widened out to support the forms, and the material was tamped under the lower flanges of the forms by a Jaeger form-tamper. A Buffalo-Springfield 12-ton roller compacted the subgrade ahead of a Buckeye R-B finegrader which traveled on the forms while leveling the subgrade to 9-in. depth. Behind the subgrader, the trimmed grade was rolled with a hand roller.

(Continued on page 156)

look into CABLE control


FLOATING MAIN SHAFT RIDING ON BALL AND ROLLER BEARINGS
ALL TRANSVERSE STRAINS TAKEN BY HOUSING (SOLID RED), NOT BY SHAFT
ALL GEARS and BEARINGS SEALED IN OIL (RED TINT)
SPIRAL BEVEL GEAR AND PINION DRIVE
GREASE RESERVOIR FOR CABLE DRUM BUSHINGS
PLANETARY TRANSMISSION DRIVES CABLE DRUMS

. . . and plan to buy Buckeye

IT'S what is inside a tractor power control unit that makes the difference in job performance. Buckeye Power Control Units are built according to finest engineering practice. The entire mechanism runs in oil, sealed against leakage and dirt. Ball and roller bearings are used throughout. Spiral bevel gear drive provides quiet, smooth running. Big clutch and braking area with external bands and molded brake lining means cool operation, long life. Planetary transmission drive of cable drums provides positive control, smooth action. Full tractor power is transmitted from power take-off through adaptor to winch.

You'll get the most out of cable control when you buy Buckeye.

BUCKEYE TRACTION DITCHER CO.
Findlay, Ohio

Trenchers
Tractor Equipment
Road Wideners

Buckeye

Convertible Shovels
Spreaders
Power Finegraders

See other Buckeye advertisement pg. 25.

GETTING THE JOB DONE WITH...

WARCO IN TIME OF WAR AND PEACE . . . Warco better-built motor graders do the job faster and easier with the simple and powerful HYDROMOTOR. The Hydromotor gives quick positive action to all operating adjustments.

W. A. RIDDELL CORP.
MANUFACTURERS OF BETTER-BUILT ROAD MACHINERY
BUCYRUS • OHIO

Construction Speeded
with the
New
CLIPPER
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JOB
PORTABLE AND EASY TO OPERATE
You'll want the New Portable Clipper Hoist on your Job . . . Quickly set up ready for use. The Clipper Hoist is operated by only one man!
FEATURES AUTOMATIC UNLOADING
FASTER . . . Brick, tile, concrete and flue lining can be hoisted to greater heights, without fatigue.
FLEXIBLE . . . Practical for every job.
THE CLIPPER MANUFACTURING COMPANY
4040 CHOUTEAU
ST. LOUIS, MO.
District Offices and Warehouses: Philadelphia, Kansas City, Austin, Tex.

(Continued from page 154)

Traveling outside the lane being paved, the dual-drum mixer deposited batches of concrete on the subgrade from a bucket operating on a 35-ft. boom. A Jaeger screw spreader distributed and leveled the concrete, and a Jaeger Type H two-screed finisher made two passes over the surface. At the suggestion of the master mechanic for the contractor, the manufacturer built frame extensions for the spreader and finisher to make the machines adjustable for widths from 12 to 14 ft. and supplied keyed shafts and collars to facilitate changing position of the wheels.

Concrete was vibrated along slab edges and at expansion joints by a gasoline-powered Jackson vibrator. The finishing machine carried the power plant of this unit. A final screeding was given the slab surface by the reciprocating screed on a Flex-Plane joint machine, which also cut the slots for the transverse contraction joints. When crossing over expansion joints, the screw of the spreader and the screeds of the finishers were raised to clear the joints. Heltzel long-handled steel straightedges and floats were used behind the joint machine, the floats being applied only where necessary.

After a burlap drag had been drawn over the concrete, and finishing had been completed along the edges and joints, the surface was sealed for curing with Aquabar sealing compound, sprayed by a portable Hudson gas-engine pump unit. Specifications stated that the sealing compound was to cover not more than 300 sq.ft. per gal., and the material proved capable of covering this maximum permitted area satisfactorily.

Personnel

For the Ohio Department of Highways, Hal G. Sours is director of highways, Glen R. Logue is assistant director and chief engineer, and R. O. Nelson is chief engineer of construction. The project here described was built under the direction of Division 12, Cleveland, Robert E. Willems, division engineer, and Hayden T. French, construction engineer, with Walter Anderson, project engineer, in charge on the job.

Work of the Horvitz Co., contractor, Cleveland, is under the engineering supervision of E. C. Blosser, chief engineer, and T. W. Kinnear, construction engineer. Construction operations on the relocation of S.R. 237 have been directed by Alvin Kohn, general superintendent, with William Smith in charge of concrete work, from rough grade to finished pavement, and Carl H. Heinzerling in charge of excavation and grading. George Swailes is the master mechanic responsible for the first-class operating condition of the contractor's equipment.

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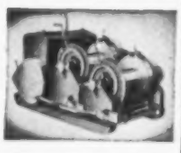
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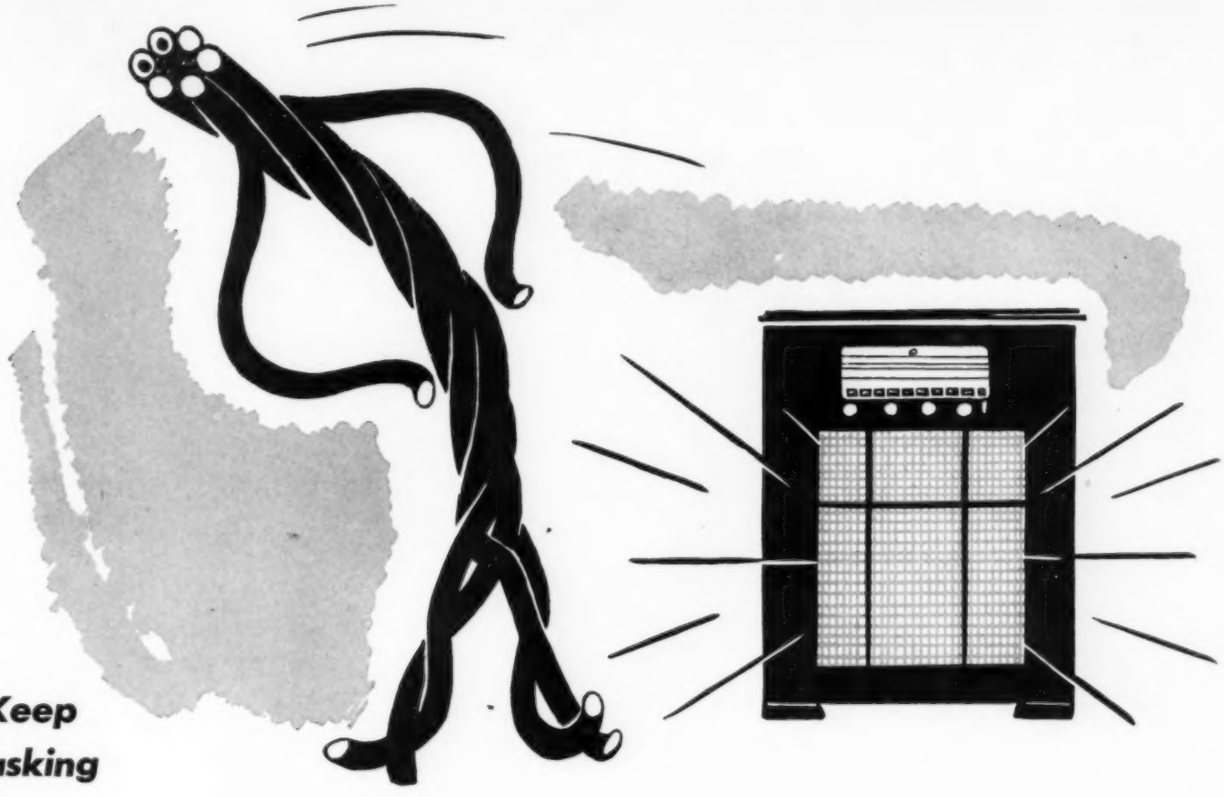

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